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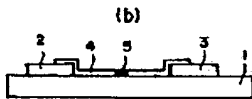
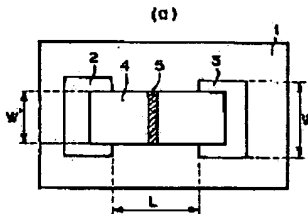
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(54) MANUFACTURE OF ELECTRON EMITTING ELEMENT, MANUFACTURE OF  
ELECTRON SOURCE AND IMAGE FORMING DEVICE USING THIS METHOD OF  
MANUFACTURE AND MANUFACTURING DEVICE USING THESE MANUFACTURING  
METHOD



(57)Abstract:

PROBLEM TO BE SOLVED: To manufacture an electron emitting element with an excellent and stable electron emitting characteristic.

SOLUTION: In a method for manufacturing an electron emitting element having a conductive film 4 having an electron emitting

part 5 and electrodes 2, 3 applying voltage to the conductive film 4, an organic substance film is applied to the conductive film 4, at least current carrying treating is performed in the conductive film 4, and the organic substance film is carbonized. Before a process of this carbonizing, a crack is formed in the conductive film 4, and the electron emitting part 5 is formed.

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#### CLAIMS

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[Claim(s)]

[Claim 1] In the manufacture approach of an electron emission component of having the conductive film which has the electron emission section, and the electrode which impresses an electrical potential difference to this conductive film The process to which the process which forms said electron emission section gives the organic substance film to the conductive film, The manufacture approach of the electron emission component characterized by having the process which performs energization processing on this conductive film at least, and carbonizes this organic substance film, and the process which forms a crack before the this carbonized process at this conductive film.

[Claim 2] The manufacture approach of the electron emission component according to claim 1 performed before the process to which the process which forms a crack in said conductive film gives an organic substance to said conductive film.

[Claim 3] The process which forms a crack in said conductive film is the manufacture approach of the electron emission component according to claim 1 performed after the process which gives an organic substance to said conductive film.

[Claim 4] The manufacture approach of an electron emission component according to claim 1 to 3 that the process which carbonizes said organic substance film is a process which performs the both sides of the energization processing to this conductive film, and heating to this organic substance film.

[Claim 5] The process which carbonizes said organic substance film is the manufacture approach of the electron emission component according to claim 1 to 4 which is the process which forms graphite from this organic substance film.

[Claim 6] The process which carbonizes said organic substance film is the manufacture approach of the electron emission component according to claim 1 to 4 which is the process which forms glassy carbon from this organic substance film.

[Claim 7] The manufacture approach of an electron emission component according to claim 1 to 6 that said organic substance film consists of thermosetting resin.

[Claim 8] Said thermosetting resin is the manufacture approach of the electron emission component according to claim 7 chosen from the inside of furfuryl alcohol, furan resin, phenol resin, the poly acrylic nitril, and rayon.

[Claim 9] The manufacture approach of an electron emission component according to claim 1 to 6 that said organic substance film consists of an electron ray polymerization resist.

[Claim 10] Said electron ray polymerization resist is the manufacture approach of the electron emission component according to claim 9 chosen from a glycidyl methacrylate-ethyl-acrylate copolymer, the Pori diallyl phthalate, a metaglycidyl acrylate-styrene copolymer, a polyimide system varnish, epoxidation 1, 4-polybutadiene, and polymethacrylic acid glycidyl.

[Claim 11] The manufacture approach of an electron emission component according to claim 1 to 10 that said conductive film contains a platinum group and the metallic element chosen from iron-group.

[Claim 12] The manufacture approach of an electron emission component according to claim 1 to 11 that said conductive film consists of a particle.

[Claim 13] Said electron emission component is the manufacture approach of the electron emission component according to claim 1 to 12 which is a surface conduction mold electron emission component.

[Claim 14] The manufacture approach of an electron source that said electron emission component is characterized by being manufactured by the approach according to claim 1 to 13 in the manufacture approach of an electron source of having two or more electron emission components.

[Claim 15] The manufacture approach of the image formation equipment characterized by manufacturing said electron emission component by the approach according to claim 1 to

13 in the manufacture approach of image formation equipment of having the image formation member which forms an image in an envelope and this envelope by the exposure of the electron emitted from the electron source which has two or more electron emission components, and this electron source.

[Claim 16] In the manufacture approach of an electron emission component of having the conductive film which has the electron emission section, and the electrode which impresses an electrical potential difference to this conductive film The process which gives the organic substance film to the conductive film, and the process which performs energization processing on this conductive film at least, and carbonizes this organic substance film, The manufacture approach of the electron emission component characterized by having the process which forms the electron emission section which has the process which forms a crack in this conductive film before the this process to carbonize, and the process which heats this electron emission component in a reactant gas's existence ambient atmosphere further.

[Claim 17] Said reactant gas is the manufacture approach of the electron emission component according to claim 16 which is oxygen.

[Claim 18] Said process to heat is the manufacture approach of the electron emission component according to claim 16 performed in atmospheric air.

[Claim 19] Said process to heat is the manufacture approach of the electron emission component according to claim 16 performed in the mixed-gas ambient atmosphere of oxygen and inert gas.

[Claim 20] Said process to heat is the manufacture approach of the electron emission component according to claim 18 or 19 performed under atmospheric pressure.

[Claim 21] Said process to heat is the manufacture approach of the electron emission component according to claim 18 or 19 performed under reduced pressure.

[Claim 22] The manufacture approach of the electron emission component according to claim 16 to 21 performed before the process to which the process which forms a crack in said electric conduction film gives an organic substance to said conductive film.

[Claim 23] The manufacture approach of the electron emission component according to claim 16 to 21 performed after the process to which the process which forms a crack in said conductive film gives an organic substance to said conductive film.

[Claim 24] The process which carbonizes said organic substance film is the manufacture approach of the electron emission component according to claim 16 to 23 which is the process which performs the both sides of the energization processing to this conductive film, and heating to this organic substance film.

[Claim 25] The process which carbonizes said organic substance film is the manufacture approach of the electron emission component according to claim 16 to 24 which is the process which forms graphite from this organic substance film.

[Claim 26] The process which carbonizes said organic substance film is the manufacture approach of the electron emission component according to claim 16 to 24 which is the

process which forms glassy carbon from this organic substance film.

[Claim 27] The manufacture approach of an electron emission component according to claim 16 to 26 that said organic substance film consists of thermosetting resin.

[Claim 28] Said thermosetting resin is the manufacture approach of the electron emission component according to claim 27 chosen from the inside of furfuryl alcohol, furan resin, phenol resin, the poly acrylic nitril, and rayon.

[Claim 29] The manufacture approach of an electron emission component according to claim 16 to 26 that said organic substance film consists of an electron ray polymerization resist.

[Claim 30] Said electron ray polymerization resist is the manufacture approach of the electron emission component according to claim 29 chosen from a glycidyl methacrylate-ethyl-acrylate copolymer, the Pori diallyl phthalate, a metaglycidyl acrylate-styrene copolymer, a polyimide system varnish, epoxidation 1, 4-polybutadiene, and polymethacrylic acid glycidyl.

[Claim 31] The manufacture approach of an electron emission component according to claim 16 to 30 that said conductive film contains a platinum group and the metallic element chosen from iron-group.

[Claim 32] The manufacture approach of an electron emission component according to claim 16 to 31 that said conductive film consists of a particle.

[Claim 33] Said electron emission component is the manufacture approach of the electron emission component according to claim 16 to 32 which is a surface conduction mold electron emission component.

[Claim 34] The manufacture approach of an electron source that said electron emission component is characterized by being manufactured by the approach according to claim 16 to 33 in the manufacture approach of an electron source of having two or more electron emission components.

[Claim 35] The manufacture approach of the image formation equipment characterized by manufacturing said electron emission component by the approach according to claim 16 to 33 in the manufacture approach of image formation equipment of having the image formation member which forms an image in an envelope and this envelope by the exposure of the electron emitted from the electron source which has two or more electron emission components, and this electron source.

[Claim 36] Said process to heat is the manufacture approach of the image formation equipment according to claim 35 performed according to the heating process for sealing said envelope.

[Claim 37] The manufacturing installation which is a manufacturing installation for enforcing the manufacture approach of image formation equipment according to claim 15, and is characterized by having a chamber room for performing the process which carbonizes said organic substance film, and a chamber room for performing the process which forms a crack in said conductive film.

[Claim 38] The manufacturing installation which is a manufacturing installation for enforcing the manufacture approach of image formation equipment according to claim 35, and is characterized by having the chamber room for performing the process which carbonizes said organic substance film, a chamber room for performing the process which forms a crack in said conductive film, and a chamber room for performing further the process which heats this electron emission component in a reactant gas's existence ambient atmosphere.

[Claim 39] The manufacturing installation according to claim 38 whose chamber room for performing the process which seals the chamber room and said envelope for performing the process which heats said electron emission component in a reactant gas's existence ambient atmosphere is the same chamber room.

[Claim 40] Furthermore, the manufacturing installation according to claim 37 to 39 which has a chamber room for performing the process which seals said envelope.

[Claim 41] Furthermore, the manufacturing installation according to claim 37 to 40 which has a chamber room for performing the process which bakes beforehand the member which constitutes said envelope.

[Claim 42] The manufacturing installation according to claim 37 to 41 which has a conveyance means for conveying a manufacture member for between said chamber room.

[Claim 43] The manufacturing installation according to claim 37 to 41 whose chamber room for performing the process which forms a crack in the chamber room and said conductive film for performing the process which carbonizes said organic substance film is the same chamber room.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the manufacture approach of of the electron source and image formation equipment using this manufacture approach, and a list further about the manufacture approach of an electron emission component at the manufacturing installation used for these manufacture approaches.

[0002]

[Description of the Prior Art] Conventionally, as an electron emission component, it divides roughly and two kinds of things using a thermionic emission component and a cold cathode electron emission component are known. There are a field emission mold (henceforth "FE mold"), a metal / insulating layer / metal mold (henceforth an "MIM mold"), a surface conduction mold electron emission component, etc. as cold cathode electron emission component.

[0003] As an example of FE mold, what was indicated by W.P.Dyke thin-film fieldemission

cathodes with molybdenum cones" J.Appl.Phys., 47, 5248 (1976), etc. is known. & W.W.Dolan, "Field emission", Advance in Electron Physics, 8 and 89 (1956) or C.A.Spindt, "PHYSICAL Properties of

[0004] As an example of an MIM mold, what was indicated by C.A.Mead, "Operation of Tunnel-Emission Devices", J.Apply.Phys., 32,646 (1961), etc. is known.

[0005] As an example of a surface conduction mold electron emission mold component, they are M.I.Elinson and Radio. Eng.Electron There are some which were indicated (1965) in Pys., 10, 1920, etc.

[0006] A surface conduction mold electron emission component uses the phenomenon which electron emission produces for the thin film of the small area formed on the substrate by passing a current in parallel with a film surface. As this surface conduction mold electron emission component, it is SnO<sub>2</sub> by said Elinson etc. The thing using a thin film, Thing [G. depended on Au thin film Dittmer:"Thin Solid Films", and In 2O<sub>3</sub> / SnO<sub>2</sub> Thing [M. by the thin film Hartwell and C.G.Fonstad:"IEEE Trans.ED Conf.", 519(1975)], [ 9,317(1972)], and ] Others [ / by the carbon thin film / thing [Araki \*\* ]: A vacuum, the 26th volume, No. 1, 22-page (1983)], etc. are reported.

[0007] As a typical example of these surface conduction mold electron emission components, above-mentioned M. Hartwell's component configuration is typically shown in drawing 20 .

[0008] In drawing 20 , as for a substrate, and 2 and 3, 1 consists of a metallic-oxide thin film with which a component electrode and 4 are conductive film, and were formed in the pattern of H mold configuration by the spatter, and the electron emission section is formed of the energization processing called the below-mentioned energization foaming. In addition, 0.5mm - 1mm and W' are set up for the component electrode spacing L in drawing by 0.1mm.

[0009] Conventionally, before performing electron emission in these surface conduction mold electron emission components, it was common to have formed the electron emission section by energization processing beforehand called energization foaming in the conductive film 4. that is, with energization foaming, to said conductive film 4 both ends, impression energization of the minute is carried out in direct current voltage or the about rising voltage /carried out very slowly, for example, 1v, and the conductive film is destroyed, deformed or deteriorated locally -- making -- electric -- high -- it is forming the electron emission section changed into the condition [ \*\*\*\* ].

[0010] In addition, a crack generates the electron emission section on some conductive film 4, and electron emission is performed from near [ the ] a crack. The surface conduction mold electron emission component which carried out said energization foaming processing impresses an electrical potential difference to the above-mentioned conductive film 4, and makes an electron emit from the above-mentioned electron emission section by passing a current for a component.

[0011] In said surface conduction mold electron emission component, this invention

person is forming by the new carbon or manufacture approach which there is not and calls the compound an activation process, and performed the proposal which improves the electron emission characteristic remarkably in the electron emission section of a surface conduction mold electron emission component (JP,7-235255,A).

[0012] With an activation process, it sets to the manufacture approach of said surface conduction mold electron emission component here. The component in which the electrode and the conductive film of a pair were formed is installed into a vacuum ambient atmosphere. After giving a foaming process, it is impressing the electrical potential difference of the shape of a pulse which introduced the organic material gas which has a new deposit and carbon common at least, and was suitably chosen by said electron emission section into the vacuum ambient atmosphere from several minutes for dozens minutes. This process is a process which increases remarkably and is improved, while it has a threshold to an electrical potential difference, the property  $I_e$ , i.e., the electron emission current, of an electron emission component.

[0013] On the other hand, although not used as an electron emission component, in the general forming method of a carbon material, the liquid phase, a gaseous phase, and solid phase carbonization are approaches learned well. For example, hydrocarbon gas, such as methane, a propane, and benzene, is introduced into a pyrosphere, they are pyrolyzed by the gaseous phase, and it is known for gaseous-phase carbonization that carbon black, graphite, a carbon fiber, etc. can be formed. Moreover, it is known for solid phase carbonization that glassy carbon will be obtained from heat-curing resin, such as phenol resin and furan resin, a cellulose, a polyvinylidene chloride, etc. (Michio Inagaki, P50-P80, carbon material engineering (Nikkan Kogyo Shimbun)).

[0014]

[Problem(s) to be Solved by the Invention] However, there was a case where the following troubles were produced, in said activation process.

[0015] In installation of the gas accompanying the trouble 1. aforementioned activation process, it needed to introduce by the pressure of the optimal gas, and especially, depending on introductory gas, the pressure is low voltage and there was a problem of control. Moreover, in the case of a pressure comparable as a vacuum ambient atmosphere, the time amount which an activation process takes was changed by the water which remains in a vacuum ambient atmosphere, oxygen, CO and CO<sub>2</sub>, hydrogen, etc., and there was a case where the descriptions of the matter deposited on the electron emission section differed. This caused dispersion in the electron emission characteristic between two or more electron emission components in the electron source which arranged two or more electron emission components, or the image formation equipment using the electron source. The electron source substrate which formed wiring linked to the electrode of two or more pairs, the conductive film, and the electrode of this pair etc. in large-sized image formation equipment especially, Maintaining the distance of several mm or less and holding the face shield which consists of a fluorescent substance etc. with the below-mentioned



housing, a spacer, etc. After making it rival at an elevated temperature and forming a vacuum envelope (it is called a sealing process), in order to impress an electrical potential difference and to perform processes, such as foaming and an activation process, from this wiring Since this distance was small, installation of the gas accompanying said activation process had the small conductance over gas, and therefore, it went over it throughout the inside of a container, and it had a problem on manufacture, such as taking long duration to obtain the pressure of fixed gas. Therefore, an option replaced with the activation approach by these gas was desired.

[0016] Water is distributed, on the other hand, when making a cellulose into a raw material as an example which obtains glassy carbon from heat-curing resin, using a centrifugal force, cellulose powder is used as a Plastic solid and dried, and it is 140kg/cm<sup>2</sup> after that. It heat-treats to baking under a pressure, heat-treats at 1300-3000 degrees C under ordinary pressure to 500 degrees C, and is made. At the time of a pyrolysis, although the opening is generating, an opening becomes small with the rise of whenever [ stoving temperature ], and if it heat-treats above 1500 degrees C, little existence of the opening is recognized (said Michio Inagaki, P50-P80, carbon material engineering (Nikkan Kogyo Shimbun)).

[0017] It was difficult to apply the general manufacture approach of such a carbon material to the activation process of an above-mentioned surface conduction mold electron emission component simply by the reasons of passing through processes, such as an elevated temperature and pressurization, to acquire a Plastic solid. Namely, since the conductive film mentioned later consists of a particle, if it is made into an elevated temperature, the conductive film will condense it. < -- depending on the case Conductivity is lost (since it will be in the condition that the condensed conductive film ingredient was isolated and does not connect electrically, the conductive film forms high resistance.). When causing a phenomenon or carbonizing by thermal decomposition, and the whole electron emission section is covered, the increment in a component current is generated and it applies to image formation equipment etc., the increment in power consumption is produced. >.

[0018] The substrate of an electron source after performing the trouble 2. aforementioned activation process, or to the member which constitutes image formation equipment, for example, the face shield which has a fluorescent substance In order to adsorb and for the gas used at the activation process and water, oxygen, CO and CO<sub>2</sub>, hydrogen, etc. to prevent stabilization of the electron emission characteristic, discharge by the gas which remains, etc. therefore The this gas by which it adsorbed needed to be removed and, for that purpose, the stabilization process which carries out long duration baking at an elevated temperature in a vacuum was required. Moreover, in order that it might receive a limit in whenever [ stoving temperature ] depending on the thermal resistance of the member used for an electron emission component, an electron source, and image formation equipment, this stabilization process existed, also when not necessarily enough.

[0019] The electron source substrate which formed wiring linked to the electrode of two or more pairs, the conductive film, and the electrode of this pair etc. conventionally in trouble 3. image formation equipment, After impressing the electrical potential difference and performing processes, such as foaming and an activation process, from this wiring after forming lamination and a vacuum envelope for the face shield which consists of a fluorescent substance etc. at an elevated temperature (it is called a sealing process), the electron emission characteristic and an image property were inspected and the vacuum envelope was closed. In these processes of a series of, since the above-mentioned sealing process is performed after assembling image formation equipment, when it is a certain cause and a defect occurs in an electron source substrate, in order to have to use image formation equipment [ all ] itself as a defective, image formation equipment was made expensive.

[0020] furthermore, these troubles -- solving -- < -- the water to each part material which carried out degasifying, oxygen, hydrogen, and CO and CO2 etc. -- the manufacture approach of image formation equipment and manufacturing installation without resoiling by re-adsorption of which > consistency was done were desired.

[0021] [Purpose of invention] this invention is more excellent in the electron emission characteristic, and aims at offering the approach for manufacturing a more stable electron emission component.

[0022] Moreover, this invention aims at offering the approach for manufacturing the electron source and image formation equipment which dispersion in the electron emission characteristic between these electron emission components reduced in image formation equipment in the electron source list which has two or more electron emission components.

[0023] Moreover, by improving the activation process for which improvement in the electron emission characteristic is benefited, this invention is more excellent in the electron emission characteristic, has two or more electron emission components in a more stable electron emission component and a list, and aims at offering the approach for manufacturing the electron source and image formation equipment which dispersion in the electron emission characteristic between these electron emission components reduced in them.

[0024] Moreover, this invention aims at offering the manufacture approach of the electron emission component which is the simple activation process for which the activation process made at the improvement sake in the electron emission characteristic does not need a difficult control process, an electron source, and image formation equipment.

[0025] Moreover, this invention aims at offering the manufacture approach of the electron emission component which does not need heating down stream processing in a pole elevated temperature, an electron source, and image formation equipment.

[0026] Moreover, this invention aims at the stabilization process for which stabilization of the activation process for which improvement in the electron emission characteristic is

benefited, and the electron emission characteristic, and discharge prevention are benefited offering the manufacture approach of the electron emission component which is the process which does not need the heat-treatment in a pole elevated temperature, an electron source, and image formation equipment.

[0027] Moreover, this invention aims at offer of a manufacturing installation which improves from that of the yield in manufacture of image formation equipment.

[0028]

[Means for Solving the Problem] This invention for attaining the above purpose has the following means.

[0029] (1) In the manufacture approach of an electron emission component of having the conductive film which has the electron emission section, and the electrode which impresses an electrical potential difference to this conductive film The process to which the process which forms said electron emission section gives the organic substance film to the conductive film, The manufacture approach of the electron emission component characterized by having the process which performs energization processing on this conductive film at least, and carbonizes this organic substance film, and the process which forms a crack before the this carbonized process at this conductive film.

[0030] (2) The manufacture approach of an electron emission component given in the above 1 performed before the process to which the process which forms a crack in said conductive film gives an organic substance to said conductive film.

[0031] (3) The process which forms a crack in said conductive film is the manufacture approach of an electron emission component given in the above 1 performed after the process which gives an organic substance to said conductive film.

[0032] (4) The manufacture approach of an electron emission component given in either of the above 1-3 whose processes which carbonize said organic substance film are processes which perform the both sides of the energization processing to this conductive film, and heating to this organic substance film.

[0033] (5) The process which carbonizes said organic substance film is the manufacture approach of an electron emission component given in either of the above 1-4 which is the processes which form graphite from this organic substance film.

[0034] (6) The process which carbonizes said organic substance film is the manufacture approach of an electron emission component given in either of the above 1-4 which is the processes which form glassy carbon from this organic substance film.

[0035] (7) The manufacture approach of an electron emission component given in either of the above 1-6 which said organic substance film becomes from thermosetting resin.

[0036] (8) Said thermosetting resin is the manufacture approach of an electron emission component given in the above 7 chosen from the inside of furfuryl alcohol, furan resin, phenol resin, the poly acrylic nitril, and rayon.

[0037] (9) The manufacture approach of an electron emission component given in either of the above 1-6 which said organic substance film becomes from an electron ray

polymerization resist.

[0038] (10) Said electron ray polymerization resist is the manufacture approach of an electron emission component given in the above 9 chosen from a glycidyl methacrylate-ethyl-acrylate copolymer, the Pori diallyl phthalate, a metaglycidyl acrylate-styrene copolymer, a polyimide system varnish, epoxidation 1, 4-polybutadiene, and polymethacrylic acid glycidyl.

[0039] (11) The manufacture approach of an electron emission component given in either of the above 1-10 in which said conductive film contains a platinum group and the metallic element chosen from iron-group.

[0040] (12) The manufacture approach of an electron emission component given in either of the above 1-11 which said conductive film becomes from a particle.

[0041] (13) Said electron emission component is the manufacture approach of an electron emission component given in either of the above 1-12 which is surface conduction mold electron emission components.

[0042] (14) The manufacture approach of the electron source characterized by said electron emission component being manufactured by the approach of a publication by either of the above 1-13 in the manufacture approach of an electron source of having two or more electron emission components.

[0043] (15) The manufacture approach of the image formation equipment characterized by said electron emission component being manufactured by the approach of a publication by either of the above 1-13 in the manufacture approach of image formation equipment of having the image formation member which forms an image in an envelope and this envelope by the exposure of the electron emitted from the electron source which has two or more electron emission components, and this electron source.

[0044] (16) In the manufacture approach of an electron emission component of having the conductive film which has the electron emission section, and the electrode which impresses an electrical potential difference to this conductive film The process which gives the organic substance film to the conductive film, and the process which performs energization processing on this conductive film at least, and carbonizes this organic substance film, The manufacture approach of the electron emission component characterized by having the process which forms the electron emission section which has the process which forms a crack in this conductive film before the this process to carbonize, and the process which heats this electron emission component in a reactant gas's existence ambient atmosphere further.

[0045] (17) Said reactant gas is the manufacture approach of an electron emission component given in the above 16 which is oxygen.

[0046] (18) Said process to heat is the manufacture approach of an electron emission component given in the above 16 performed in atmospheric air.

[0047] (19) Said process to heat is the manufacture approach of an electron emission component given in the above 16 performed in the mixed-gas ambient atmosphere of

oxygen and inert gas.

[0048] (20) Said process to heat is the manufacture approach of an electron emission component the above 18 performed under atmospheric pressure, or given in 19.

[0049] (21) Said process to heat is the manufacture approach of an electron emission component the above 18 performed under reduced pressure, or given in 19.

[0050] (22) The manufacture approach of an electron emission component given in either of the above 16-21 performed before the process to which the process which forms a crack in said electric conduction film gives an organic substance to said conductive film.

[0051] (23) The manufacture approach of an electron emission component given in either of the above 16-21 performed after the process to which the process which forms a crack in said conductive film gives an organic substance to said conductive film.

[0052] (24) The process which carbonizes said organic substance film is the manufacture approach of an electron emission component given in either of the above 16-23 which is the processes which perform the both sides of the energization processing to this conductive film, and heating to this organic substance film.

[0053] (25) The process which carbonizes said organic substance film is the manufacture approach of an electron emission component given in either of the above 16-24 which is the processes which form graphite from this organic substance film.

[0054] (26) The process which carbonizes said organic substance film is the manufacture approach of an electron emission component given in either of the above 16-24 which is the processes which form glassy carbon from this organic substance film.

[0055] (27) The manufacture approach of an electron emission component given in either of the above 16-26 which said organic substance film becomes from thermosetting resin.

[0056] (28) Said thermosetting resin is the manufacture approach of an electron emission component given in the above 27 chosen from the inside of furfuryl alcohol, furan resin, phenol resin, the poly acrylic nitril, and rayon.

[0057] (29) The manufacture approach of an electron emission component given in either of the above 16-26 which said organic substance film becomes from an electron ray polymerization resist.

[0058] (30) Said electron ray polymerization resist is the manufacture approach of an electron emission component given in the above 29 chosen from a glycidyl methacrylate-ethyl-acrylate copolymer, the Pori diallyl phthalate, a metaglycidyl acrylate-styrene copolymer, a polyimide system varnish, epoxidation 1, 4-polybutadiene, and polymethacrylic acid glycidyl.

[0059] (31) The manufacture approach of an electron emission component given in either of the above 16-30 in which said conductive film contains a platinum group and the metallic element chosen from iron-group.

[0060] (32) The manufacture approach of an electron emission component given in either of the above 16-31 which said conductive film becomes from a particle.

[0061] (33) Said electron emission component is the manufacture approach of an electron

emission component given in either of the above 16-32 which is surface conduction mold electron emission components.

[0062] (34) The manufacture approach of the electron source characterized by said electron emission component being manufactured by the approach of a publication by either of the above 16-33 in the manufacture approach of an electron source of having two or more electron emission components.

[0063] (35) The manufacture approach of the image formation equipment characterized by said electron emission component being manufactured by the approach of a publication by either of the above 16-33 in the manufacture approach of image formation equipment of having the image formation member which forms an image in an envelope and this envelope by the exposure of the electron emitted from the electron source which has two or more electron emission components, and this electron source.

[0064] (36) Said process to heat is the manufacture approach of image formation equipment given in the above 35 performed according to the heating process for sealing said envelope.

[0065] (37) The manufacturing installation which is a manufacturing installation for enforcing the manufacture approach of the image formation equipment a publication to the above 15, and is characterized by having a chamber room for performing the process which carbonizes said organic substance film, and a chamber room for performing the process which forms a crack in said conductive film.

[0066] (38) The manufacturing installation which is a manufacturing installation for enforcing the manufacture approach of the image formation equipment a publication to the above 35, and is characterized by to have the chamber room for performing the process which carbonizes said organic substance film, a chamber room for performing the process which forms a crack in said conductive film, and a chamber room for performing further the process which heats this electron emission component in a reactant gas's existence ambient atmosphere.

[0067] (39) A manufacturing installation given in the above 38 whose chamber room for performing the process which seals the chamber room and said envelope for performing the process which heats said electron emission component in a reactant gas's existence ambient atmosphere is the same chamber room.

[0068] (40) A manufacturing installation given in either of the above 37-39 which has a chamber room for furthermore performing the process which seals said envelope.

[0069] (41) A manufacturing installation given in either of the above 37-40 which has a chamber room for performing the process which furthermore bakes beforehand the member which constitutes said envelope.

[0070] (42) A manufacturing installation given in either of the above 37-41 which has a conveyance means for conveying a manufacture member for between said chamber room.

[0071] (43) A manufacturing installation given in either of the above 37-41 whose chamber rooms for performing the process which forms a crack in the chamber room and said

conductive film for performing the process which carbonizes said organic substance film are the same chamber rooms.

[0072] According to the manufacture approach of an electron emission component of having the activation process which consists of the spreading process and carbonization process of an organic material of [operation] this invention, conventionally, needed to set at said activation process, needed to control and introduce gas by the pressure of the optimal gas, but The spreading process of the organic material of the activation process of the electron emission component of this invention Since thermosetting resin and an electron ray polymerization resist are dissolved with a suitable solvent, a prepolymerization object is applied and control of the pressure of introductory gas etc. becomes unnecessary, the pressure control in the conventional activation process and the effect of the gas which remains in a vacuum ambient atmosphere are eased, and it can control easily. < -- < -- since an organic material is the applied coat and vapor pressure is smallness, heating at an activation process is also attained and an activation process is shortened again. >>.

[0073] Moreover, the carbonization process of the activation process of the electron emission component of this invention The time amount of the process which makes the above-mentioned organic material deteriorate according to concomitant use of < energization processing or energization processing, and heat-treatment, the amount of energy (in the case of heat) When based on energization, such as temperature, since a carbonization object is fixed at least to the electron emission section by control of the electrical potential difference of the pulse given to the both ends of a component electrode, width of face, and coverage, it can control by it easily.

[0074] < -- < -- since energization energy is a subject's carbonization, a crack is maintained by the electron emission section and the nonlinear characteristic over the component electrical potential difference of the emission current is maintained again. Also about the emission current, since nonlinearity is maintained, there is no increment in power consumption etc. >>.

[0075] Furthermore, good carbon is easily formed by choosing a catalyst nature ingredient as a conductive film ingredient.

[0076] < -- since energization energy is based on local heat energy thru/or a local electron ray, it does not generate but condensation of on the conductive whole film can hold conductivity again. >.

[0077] Therefore, in the electron source which arranged two or more electron emission components, or image formation equipment, since it is the activation process controlled easily compared with the controllability of the conventional activation process, dispersion in the property etc. can be controlled.

[0078] Moreover, since it is performed after the stabilization process which heats in the reactant gas of this invention performs said activation process, and the difference of the resistance over the reactant gas between the intermediate product in said activation

process and a carbonization object is used, an intermediate product is removed easily for a short time, and saves the property of the surface conduction mold electron emission component moreover remarkably improved at the activation process. Therefore, the above-mentioned trouble in the conventional stabilization process is solved, and suppression of discharge and stabilization of the electron emission characteristic are made. Furthermore, a heat treatment process can also be shortened by performing the stabilization process of this invention to an above-mentioned sealing process and coincidence.

[0079] Moreover, since only the excellent article with which the electron source and the face shield were inspected can perform assembly of a back process according to the manufacture approach of image formation equipment of having the process which assembles a vacuum envelope with the production process of an electron source substrate of this invention and its inspection, the production process of a face shield and its inspection, an electron source substrate, and the face shield that has an image formation member, image formation equipment can be manufactured cheaply.

[0080] Moreover, since the intermediate product produced at the activation process is removed and removal of water, oxygen, CO and CO<sub>2</sub>, hydrogen, etc. serves as a subject from an electron source substrate beforehand in the process which seals and assembles the face shield which has the substrate of an electron source, and a fluorescent substance, stable image formation equipment can be manufactured easily.

[0081] the manufacture approach of above-mentioned image formation equipment -- < -- the water to each part material which carried out degasifying, oxygen, hydrogen, and CO and CO<sub>2</sub> etc. -- the high image formation equipment of the yield can be realized to > stability like by considering as the manufacturing installation in the inside of a vacuum consistently especially by considering as the consistent manufacturing installation without contamination by resorption, without taking out the whole manufacture of image formation equipment in atmospheric air for every process.

[0082]

[Embodiment of the Invention] This invention offers the new method of activating the electron source which has arranged two or more surface conduction mold electron emission components and these electron emission components, the stabilization process of a component property, and the new manufacturing method of image formation equipment.

[0083] First, the fundamental configuration of the surface conduction mold electron emission component of this invention is explained.

[0084] Drawing 1 is the mimetic diagram showing the configuration of the surface conduction mold electron emission component of this invention, drawing 1 (a) is a top view and drawing 1 (b) is a sectional view.

[0085] In drawing 1, although, as for 3, the expression by the side of high potential and low voltage is often carried out to a substrate and <2 among a component electrode, in



addition the example of this invention, 1 High potential is impressed to the component electrode 2 at low voltage and the component electrode 3, and it will call a high potential side including the conductive film by the side of the component electrode 3 including the conductive film by the side of the component electrode 2 a low voltage side and bordering on the electron emission section bordering on the electron emission section. As for > and 4, the conductive film and 5 are the electron emission sections.

[0086] It is SiO<sub>2</sub> which formed impurity contents, such as quartz glass and Na, in the glass which decreased in number, blue plate glass, and blue plate glass by the spatter etc. as a substrate 1. The ceramics, Si substrates, etc., such as a glass substrate which carried out the laminating, and an alumina, can be used.

[0087] A common conductor material can be used as an ingredient of the component electrodes 2 and 3 which counter. the printed conductor with which this consists of metals, such as metals, such as nickel, Cr, Au, Mo, W, Pt, Ti, aluminum, Cu, and Pd, or an alloy and Pd, Ag, Au and RuO<sub>2</sub>, and Pd-Ag, or a metallic oxide, glass, etc., and In<sub>2</sub>O<sub>3</sub>-SnO<sub>2</sub> etc. --- it can choose from semi-conductor conductor material, such as a transparence conductor and polish recon, etc. suitably.

[0088] The configuration of the component electrode spacing L, component electrode die-length W, and the conductive film 4 etc. is designed in consideration of the gestalt applied. The component electrode spacing L can be made into the range of hundreds of micrometers from thousands 0.1nm times, and can be more preferably made into the range of several micrometers to dozens of micrometers in consideration of the electrical potential difference impressed to component inter-electrode.

[0089] Component electrode die-length W can be made into the range of several micrometers to hundreds of micrometers in consideration of the resistance of an electrode, and the electron emission characteristic.

[0090] Thickness d of the component electrodes 2 and 3 can be made into the range of several micrometers from hundreds 0.1nm times.

[0091] In addition, it can also consider as the configuration which carried out the laminating at the order of the conductive film 4 and the component electrodes 2 and 3 which counter not only the configuration shown in drawing 1 but on the substrate 1.

[0092] It is desirable to use for the conductive film 4 the particle film which consisted of particles, in order to acquire the good electron emission characteristic.

[0093] Moreover, although the thickness is suitably set up in consideration of the step coverage to the component electrodes 2 and 3, the component electrode 2, the resistance between three, the foaming conditions mentioned later, it is more preferably [ usually preferably / considering as the thousands times as many range of 0.1nm as this from several 0.1nm times / and ] better than 1nm to consider as the range of 50nm.

[0094] moreover, the resistance --- Rs --- 102 from --- 107 It is the value of omega/\*\*. In addition, Rs is a numeric value expressed when thickness sets the resistance R of the thin film of 1 with t and die length sets [ width of face ] it with  $R=R_s (1/w)$  by w.

[0095] In this application specification, although energization processing is mentioned as an example and explained about foaming processing, foaming processing is not restricted to this and includes the processing which the film is made to produce a crack and forms a high resistance condition.

[0096] As an ingredient which constitutes the conductive film 4, metals, such as Pd, Pt, Ru, Ag, Au, Ti, In, Cu, Cr, Fe, nickel, Zn, Sn, Ta, W, and Pb, PdO, SnO<sub>2</sub>, In<sub>2</sub>O<sub>3</sub>, PbO, and Sb<sub>2</sub>O<sub>3</sub> etc. -- an oxide -- HfB<sub>2</sub>, ZrB<sub>2</sub> and LaB<sub>6</sub>, CeB<sub>6</sub>, YB<sub>4</sub>, and Gd<sub>2</sub>B<sub>4</sub> etc. -- it is suitably chosen from semi-conductors, such as nitrides, such as carbide, such as boride, and TiC, ZrC, HfC, TaC, SiC, WC, and TiN, ZrN, HfN, and Si, germanium, carbon, etc. Among these, iron-group [ , such as platinum groups which are catalyst nature metals, such as Pd and Pt, and nickel, Co, ] is desirable when forming good carbon easily.

[0097] Next, the particle film described here is film which two or more particles combined, and the condition to which the particle distributed the fine structure separately, or the particle has taken mutually contiguity or the condition (it contains, also when some particles gather and island-shape structure is formed as a whole) of having overlapped. the particle size of a particle -- the thousands times as many range of several 0.1nm times to 0.1nm as this -- it is the range of 1 to 20nm preferably.

[0098] In addition, since the word "particle" is frequently used on these specifications, the semantics is explained.

[0099] A "particle", a call, and what is smaller than this are called a "ultrafine particle" for a small particle. It is performed widely that the number of atomic calls a "cluster" about hundreds of or less things still smaller than a "ultrafine particle."

[0100] However, each boundary is not strict and it changes by paying attention to what kind of property it classifies. Moreover, a "particle" and a "ultrafine particle" may be collectively called a "particle", and description in this specification meets this.

[0101] It is described as follows by "the experimental physics lecture 14 front face and the particle" (the volume on Koreo Kinoshita , KYORITSU SHUPPAN September 1, 1986 issue).

[0102] "When calling it a particle in this paper, the diameter carries out to from about 2-3 micrometers to about 10nm generally, and when calling it especially an ultrafine particle, particle size will mean from about 10nm to about 2-3nm. Since both are only collectively written to be particles, it is by no means strict, and they are most standards. In the case of dozens - about 100 numbers, the number of the atoms which constitute a particle calls it a cluster from two pieces. " (195 pages the 22-26th line).

[0103] When added, the minimum of particle size was still smaller and those of the definition of the "ultrafine particle" in "the wood and ultrafine particle project" of the Research Development Corporation of Japan was as follows.

[0104] "In the "ultrafine particle project" (1981-1986) of Exploratory Research for Advanced Technology, the magnitude (path) of a particle decided to call the thing of the range of about 1-100nm a "ultrafine particle" (ultra fine particle). Then, one ultrafine

particle is about 100–108. It will be called the aggregate of the atom like an individual. if it sees with an atomic scale, ultrafine particles will be size – a giant particle. what is still smaller than” (volume “ultrafine particle–creation technology [ – ]” wood Chikara, Ryoji Ueda, and on Tazaki \*\* ; Mita publication 1–4th 1988 2 pages line) “ultrafine particle, i.e., an atom, -- some – one particle which consists of hundreds of pieces is usually called a cluster -- ” (this two–page writing of the 12–13th line) .

[0105] Based on the above general ways of calling, in this specification, a “particle” is the aggregate of many atoms and molecules, and suppose that the minimum of particle size points out 0.1nm several times as many – [ as this ] about 1nm, and an upper limit points out an about several micrometers thing.

[0106] The electron emission section 5 is constituted the crack and near the high resistance, and becomes a thing depending on technique, such as thickness of the conductive film 4, membraneous quality, an ingredient and energization foaming mentioned later, and activation, etc. [ which were formed in some << conductivity film 4 ] It is the structure of having the crack still narrower than the crack in which the film made from carbon was further formed of activation of this invention inside the crack formed by energization foaming, and was further formed inside by energization foaming of it which consisted of carbon materials. For this reason, the emission current of the component of this invention is a nonlinear device for which the emission current depends nonlinear to the electrical potential difference impressed to a component. In addition, although this carbon may be formed also on the conductive film, it depends for the condition of covering of this carbon on a configuration, the activation approach, the stabilization approach, etc. of a device. Since the covering fields on the conductive film decrease in number especially depending on sufficient stabilization process, it is thought that distribution of the carbonaceous quality has occurred. The conductive particle of the particle size of the hundreds times as many range of 0.1nm as this may exist in the interior of the crack which consisted of carbon materials from several 0.1nm times. This conductive particle contains the part or all the elements, and carbon of an element of the ingredient which constitutes the conductive film 4. >>.

[0107] Next, the manufacture approach of this invention is explained.

[0108] The flow Fig. of the manufacture approach of this invention is shown in drawing 2 . For details, it explains in an example.

[0109] The method of activating this invention is a polymerization and a thing which carbonizes and improves a component property by concomitant use of the energization processing to >> component, or local or overall heating and energization processing, after applying an organic material to the component before performing foaming of the conductive film of << above–mentioned and performing energization foaming, or after applying an organic material to the component which performed foaming of the above–mentioned conductive film. < -- < -- activation of this invention in addition, in order that concentration of electric field may take place to the crack of the conductive film formed

by energization foaming and energization energy may concentrate on the edge of the crack, since it is carried out by energization after performing energization foaming and forming a crack Easily, the applied organic material is carbonized and it is thought that the crack which consists of a carbon material which hung with this energization energy and existed is formed inside a crack of the crack conductivity film. >>.

[0110] Here, as an organic material, thermosetting resin or electron ray NEGAREJISUTO (electron ray polymerization resist) is used preferably.

[0111] As thermosetting resin, the prepolymerization object which dissolved [ 1st ] furfuryl alcohol, furan resin, phenol resin, etc. with the suitable solvent is used preferably. It is known well that these ingredients will generally form glassy carbon thermally. Here, the microcrystal dimension of glassy carbon is small and it is random layer structure, as a detailed organization, points out what has taken the non-orientation organization, and, generally is said for a high degree of hardness and compactness to be high. These material properties are because it is [ as opposed to / a life, discharge, etc. / for a surface conduction mold electron emission component ] effective.

[0112] PORIA chestnut nitril, rayon, etc. are preferably used for the 2nd. For example, since the molecule frame is inherited by the carbon side as it is in a carbonization process in the case of the poly acrylic nitril, graphite is formed easily. Graphite is also an ingredient advantageous to the property of a surface conduction mold electron emission component.

[0113] Moreover, the these glycidyl methacrylate-ethyl-acrylate copolymer which a glycidyl methacrylate-ethyl-acrylate copolymer, the Pori diallyl phthalate, a metaglycidyl acrylate-styrene copolymer, a polyimide system varnish, epoxidation 1, 4-polybutadiene, polymethacrylic acid glycidyl, etc. are raised, and divides and is excellent in the sensibility of NEGAREJISUTO as electron ray NEGAREJISUTO (electron ray polymerization resist), epoxidation 1, and 4-butadiene are desirable.

[0114] Since it activates easily with an electron ray, electron ray NEGAREJISUTO is advantageous at the carbonization process mentioned later. Moreover, also in case the surface conduction mold electron emission component of this invention is driven, also when the stabilization process mentioned later is inadequate temporarily, in order that a polymerization and carbonization may progress with an electron ray, it is effective for prevention of discharge etc.

[0115] It is made by repeating a polymerization and pulse [ which is shown in a component electrode at drawing 3 (a) and (b) the 1st in order to carbonize ]-like electrical potential difference, and giving these organic materials, and energization processing. The triangular wave which the electrical potential difference impressed to the electronic electrodes 2 and 3 for every pulse shown not only in the square wave shown in drawing 3 (a) but in drawing 3 (b) reverses is sufficient as a pulse-like voltage waveform, and the pulse width T1, the pulse period T2, and peak value set up energy, such as a polymerization, heat required for carbonization, and an electron ray, and are set up suitably. Moreover, the

same electrical potential difference as driver voltage of the peak value of a pulse voltage is desirable, and this electrical potential difference is an electrical potential difference higher than a foaming electrical potential difference. According to the component current which can be guessed easily, this resistance welding time gets to know the condition of advance of an activation process, and is set up the property of a component, and here. Moreover, pulse shape may be changed into activation time amount. < -- < -- in addition, carbonaceous formation has a dependency to the energization direction, and is mainly formed in the side which impressed high potential. For this reason, if it carries out reversing the energization direction, there will be no dependency of the energization direction inside a crack of the conductive film, and it will be formed in it at the both sides of a crack. >>.

[0116] It is good for the energization processing and coincidence which are the 1st approach the 2nd also by the whole heating [ near / by laser / the electron emission section ], thermostat, belt furnace, infrared-oven, etc. heating. In the case of laser, the temperature in this case is set up by power, a pulse period, etc., and is suitably set up with an above-mentioned ingredient. < -- < -- in addition, this carbonization process may be lower than the energy in the energization processing which is the sum total of an approach and the energy of heat tracing by energization, and is the 1st approach since it is carried out enough. < -- < -- since the ingredients used by this invention are solid-states, such as a prepolymerization object instead of a gas, with a natural thing, although an activation rate will fall if it heats, by the conventional activation using an organic gas, an activation rate increases rather again. it is thought that this has suggested that carbonization at an activation process has carbonized the organic material (adsorption -- or applied) which exists near the crack. For this reason, if adsorption of the organic material from a gaseous organic material to near the crack is heated, it will be controlled, and it is thought that an activation rate decreases. Here, it defines from the time amount for reaching a certain component current or emission current, and activation time amount becomes long and the activation rate is disadvantageous on a manufacturing method, if an activation rate is smallness. If an activation rate is size, activation time amount becomes short and is advantageous on a manufacturing method. >>.

[0117] The stabilization process of this invention uses the resistance difference over a stabilization process with the intermediate product of the above-mentioned activation process, and an end product. The tolerant conceptual diagram to the reactant gas of an intermediate product and a carbonization object is shown in drawing 4 . An axis of abscissa is heating precision and an axis of ordinate is conversion. In addition, in drawing 4 , a reactant gas kind, an introductory partial pressure, etc. are fixed cases. Conversion is a rate which an ingredient reacts with reactant gas and is removed. The order of a prepolymerization object, an intermediate product, and a carbonization object understands that reaction removal is carried out at low temperature. When reactant gas does not exist with a natural thing, since the relation of such conversion and temperature becomes a

pyrolysis, it is shifted to an elevated-temperature side in a vacuum. For this reason, a long duration important point is carried out at the stabilization process by baking in the inside of the conventional vacuum.

[0118] According to the stabilization process of this invention, organic substance film, such as a prepolymerization object, an intermediate product, a carbonization object, etc. in therefore, the condition of having mixed Since organic substance film, such as a prepolymerization object, and an intermediate product are removed and a carbonization object is saved when activation is completed Various problems which originate in the gas which occurs from organic substance film, such as a prepolymerization object, and an intermediate product, and are produced during the drive of the discharge to generate, compaction of a life, the instability of a component property, etc. are solved.

[0119] In addition, conventionally, depending on the temperature resistance of the ingredient used for an electron emission component, it was not raised at the stabilization process in the inside of the vacuum by this invention person etc. to an elevated temperature, but there was a case where these problems were produced.

[0120] Moreover, as reactant gas, it reacts with an organic material and a carbon dioxide, a carbon monoxide, and the oxygen changed to water are suitable. Moreover, the type of gas, a partial pressure, etc. are suitably set up according to the ingredient used. If it is at the sealing time and carries out to coincidence in the assembly of the image formation equipment which is mentioned later according to the mixed gas of oxygen and nitrogen when atmospheric air is especially made into reactant gas or, it can serve like the heat process at the time of sealing, and is advantageous on process compaction. In addition, as for sealing temperature, a 350-450-degree C thing is suitably chosen according to the resistance of the following carbon by selection of frit glass. Moreover, if it carries out under atmospheric pressure, since it is not necessary to decompress, it is advantageous.

[0121] In addition, although graphite is removed from about 500 degrees C among atmospheric air, an intermediate product begins to be removed from 200-degree-C grade. At 400 degrees C, an intermediate product is removed nearly completely. Organic substance film, such as a prepolymerization object, is removed similarly. In this way, the intermediate product with which it generates gas when an electron emission component drives, and it becomes factors, such as discharge, is removed, and a component property is stabilized. < -- the temperature raised here -- to the last -- the inside of atmospheric air -- and it is the case of the film thick enough, and when it thin-film-izes, it is in a fall inclination. For this reason, oxygen tension is set up whenever [ stoving temperature ] according to conditions. Moreover, whenever [ stoving temperature ] is made into low temperature by making whenever [ stoving temperature ] into an elevated temperature, and making oxygen into a low partial pressure, and since there is an inclination which can be set as the same stabilization process conditions by raising oxygen tension, as for this process, a degree of freedom can be given to some extent to the sealing temperature of image formation equipment. >.

[0122] Next, especially this invention that can be set like an erector is described at the time of manufacture of image formation equipment. The production process and manufacturing installation of image formation equipment of this invention are explained. The flow Fig. of an example of the manufacture approach is shown in drawing 5. It is divided into the process which assembles a vacuum envelope with the production process of an electron source substrate, its inspection, the production process of a face shield, its inspection, an electron source substrate, and the face shield that has an image formation member in this invention. In addition, this manufacture flow is the example which established the stabilization process and the sealing process separately. Although mixed by the language of a display panel and image formation equipment, the gestalt before a drive circuit etc. is prepared is called a display panel.

[0123] First, the manufacture approach is explained.

[0124] The creation process of a face shield (process 1) (creation and inspection of a face shield)

Although an example describes to a detail, after face shields are print processes and slurry method and form a fluorescent substance in a glass substrate, they conduct inspection of a fluorescent substance pattern. The housing which constitutes the container of a display panel is beforehand pasted up on the periphery section of a face shield with frit glass. Moreover, it is desirable to paste up the atmospheric pressure-proof structure called a spacer to it when a large-sized display panel is constituted in coincidence on a face shield side. Furthermore, a sheet frit is arranged to jointing with the rear plate of a housing.

[0125] Furthermore, it is a process except the water by which the face shield (baking process of a face shield) was adsorbed, oxygen, CO and CO<sub>2</sub>, hydrogen, etc., and whenever [ stoving temperature ], and heating time are set up suitably, and it bakes in a vacuum.

[0126] The creation process (rear plate) of a rear plate (process 2)

At this process, the conductive film, two or more electron emission components in the condition of having been formed, wiring, etc. are created on a substrate. In addition, as mentioned above, it may be in the condition that the organic material was applied in this condition (refer to drawing 2).

[0127] Furthermore, a (rear plate baking process) is performed. the water by which the rear plate was adsorbed, and CO and CO<sub>2</sub> etc. -- it is the process to remove, and whenever [ stoving temperature ], and heating time are set up suitably, and it bakes in a vacuum.

[0128] (Process 3) The above-mentioned foaming is performed (foaming process).

[0129] (Process 4) The above-mentioned organic material is applied (spreading process of an organic material).

[0130] (Process 5) It carries out by energizing the process which carbonizes the organic material by which the laminating was carried out (carbonization process). Inspection of a

component current can be conducted after carbonization process termination, and it can also consider as inspection of an electron source substrate. In addition, this is because a component current and the emission current are connected with fixed relation. Moreover, as mentioned above, heating is also effective in advancing a carbonization process in the case of energization.

[0131] (Process 6) The above-mentioned stabilization process is performed (stabilization process). After a stabilization process, electron source substrates, such as a component current and the emission current, are inspected.

[0132] In addition, let a measurement environment be a vacuum in this case.

[0133] (Process 7) A rear plate and a face shield are pasted up with the frit glass which installed the housing beforehand (sealing process).

[0134] (Process 8) An exhaust pipe is closed when there is an exhaust pipe. Here, in order to maintain the degree of vacuum in a display panel, the flash plate of the getter is carried out.

[0135] (Process 9) Electric inspection of the display panel created in this way is carried out. Here, the component current and the emission current of each component, the brightness of the fluorescent substance of each pixel, etc. are inspected.

[0136] In this way, the created display panel is mounted in a drive circuit, a circumference circuit, etc., and image formation equipment is completed.

[0137] In order that according to the surface conduction mold electron emission component manufacture approach of this invention mentioned above the production process of such an electron source substrate may be the phase which finished formation of a component electrode, the activation process which becomes the conductive film from formation, spreading of an organic material, and a carbonization process, and the stabilization process and an electron source substrate may complete it, inspection of the property of each electron emission component is made, and the inspection as an electron source is made. Therefore, since only the excellent article with which the electron source and the face shield were inspected can perform assembly of a back process, cheap image formation equipment is realizable. In addition, the process of a face shield is explained in full detail in the example.

[0138] Next, the production process which realizes the production process of this invention of image formation equipment is explained.

[0139] The manufacture approach of a display panel consists of load lock system vacuum chambers for the pollution control by re-adsorption of water [ to each part which carried out degasifying ], oxygen, hydrogen, CO, and CO<sub>2</sub> grade. Fundamentally A (rear plate load room), a (rear plate baking room), A (foaming room), a (carbonization room), a (stabilization room), a (sealing room), a (face shield load room), It consists of a (face shield baking room) and a (annealing room), each chamber has divided between chambers and can hold a vacuum independently between each chamber, and a substrate is conveyed by the following chamber after finishing the process in each chamber.



[0140] A rear plate is thrown in from a (rear plate load room), performs a (stabilization room) and each process and is conveyed. On the other hand, a face shield is thrown in from a (face shield load room), it is conveyed through a (face shield baking room) at the above-mentioned (sealing room), and a display panel is assembled on the rear plate which finished the stabilization process. The container assembled at the end is conveyed at an annealing room, and is annealed to a room temperature. The exhaust air system which consists of vacuum pumps of each \*\* and an oil free-lancer is attached. Moreover, (stabilization (carbonization (foaming room) room) room), it sets and not only each electrical treatment but electric inspection can be conducted. The gas for stabilizing can be introduced now into stabilization and a sealing room. Moreover, the effectiveness of compaction of a process etc. is acquired by carrying out by the same chamber of foaming and a carbonization process, or performing a sealing process by the same chamber a stable chemically-modified degree.

[0141] In addition, this manufacturing installation is an example, is not necessarily restricted to this and should just satisfy each above-mentioned process.

[0142]

[Example]

[Example 1] drawing 1 is drawing showing the structure of the surface conduction mold electron emission component of the example 1 of this invention, drawing 1 (a) is a top view and drawing 1 (b) is the cross section.

[0143] For 1, as for a component electrode and 4, in drawing 1 , a substrate, and 2 and 3 are [ the conductive film and 5 ] the electron emission sections.

[0144] Moreover, drawing 6 is drawing showing the production process of this example. Hereafter, this invention is concretely explained using drawing 6 which shows the procedure of the manufacture approach of this invention.

[0145] Moreover, the surface conduction mold electron emission component as an example 1 of a comparison was also produced.

[0146] The substrate which forms A substrate and the surface conduction mold electron emission component of the example of a comparison for the substrate which forms the surface conduction mold electron emission component of this invention will be called B substrate after this.

[0147] In addition, four components of the same configuration are formed on a substrate.

[0148] First, the process of the substrate A of this invention is shown.

[0149] : (substrate washing / component electrode formation process) (Process 1) 30nm was fully deposited on the substrate by the spatter by using Pt as a component electrode material with a detergent, pure water, and an organic solvent, respectively, using a mask as component electrodes 2 and 3, having used the substrate 1 as the washing back.

[0150] Then, vacuum deposition of the Cr film for lift off was further carried out by 100nm thickness for the purpose of patterning of the conductive film 4 ( drawing 6 a).

[0151] Moreover, the component electrode spacing L and the component electrode length

W could be 10 micrometers and 100 micrometers, respectively.

[0152] : (conductive film formation process) (Process 2) Between the component electrodes 2 and the component electrodes 3 which were formed on the substrate 1, the organic metal thin film was formed by carrying out rotation spreading with a spinner and leaving an organic palladium solution (CCP4230 made from Okuno Pharmaceuticals).

[0153] Then, heating baking processing of this organic metal thin film was carried out in atmospheric air for 10 minutes at 300 degrees C. In this way, the thickness of the conductive film 4 which consists of a formed particle which mainly consists of PdO is about 10nm, and sheet resistance is  $5 \times 10^4$ . They were  $\omega/\omega^*$ .

[0154] Then, wet etching of Cr film and the conductive film 4 after baking was carried out by acid etchant, and it formed in the desired pattern ( drawing 6 b).

[0155] (Process 3) : (organic material spreading process), next the organic material 7 used as the characteristic process of this invention are applied ( drawing 6 (c)). At this example, after applying all over a substrate so that it may become the thickness of 20nm with a spinner using the poly acrylic nitril which is heat-curing mold resin by using demethyl foramide as a solvent, it prebaked at 100 degrees C. In addition, what is necessary is just to apply it on the conductive film, even if spreading of an organic material is not the whole substrate surface. Here, lift off was used.

[0156] (Process 4) : (foaming process), then Substrate A were installed in the vacuum processor of drawing 7 , after evacuation, the pulse-like electrical potential difference was impressed between the component electrode 2 and 3, and energization processing called foaming was performed ( drawing 6 d).

[0157] In addition, the foaming voltage waveform was the square wave of 10 mses about 1 ms and pulse separation T2 in pulse width T1, and it was performed under the vacuum ambient atmosphere of ten to 5 Pa, making a pulse height value increase gradually.

[0158] Drawing 7 is the mimetic diagram showing a vacuum processor, and also has the function as measurement evaluation equipment.

[0159] In drawing 7 , 75 is a vacuum housing and 76 is an exhaust air pump. The electron emission component is allotted in the vacuum housing 75. That is, 1 is a base which constitutes an electron emission component, and, as for a component electrode and 4, 2 and 3 are [ the conductive film and 5 ] the electron emission sections. An ammeter for a power source for 71 to impress the component electrical potential difference  $V_f$  to an electron emission component and 70 to measure the component current  $I_f$  which flows the component electrode 2 and the conductive film 4 between three, and 74 are the anode electrodes for catching the emission current  $I_e$  emitted from the electron emission section 5 of a component. A high voltage power supply for 73 to impress an electrical potential difference to the anode electrode 74 and 72 are the ammeters for measuring the emission current  $I_e$  emitted from the electron emission section 5 of a component.

[0160] Moreover, in the vacuum housing 75, the device required for the measurement under vacuum ambient atmospheres, such as a non-illustrated vacuum gage, is prepared,

and measurement evaluation under a desired vacuum ambient atmosphere can be performed now. The exhaust air pump 76 is constituted by the usual high vacuum equipment system which consists of a turbine pump and a rotary pump, and the ultra-high-vacuum equipment system which consists of an ion pump etc. further. Furthermore, mixed chemical cylinders, such as the oxygen cylinder 77 for performing a stable chemically-modified [ of this invention ] degree or oxygen, are arranged. Moreover, it is the ampul 78 of the acetone which is an activation ingredient.

[0161] Moreover, the whole vacuum processor which arranged the electron source substrate shown in drawing 7 can be heated to 450 degrees C at a non-illustrated heater. Therefore, if this vacuum processor is used, the process after the above-mentioned energization foaming can also be performed.

[0162] (Process 5) It energized for 15 minutes with the degree of vacuum of ten to 5 Pa by the square wave pulse ( $T_1=1\text{ms}$  and  $T_2=10\text{ms}$ ) shown in : (carbonization process) next driver voltage 15V, and drawing 3 (a). In the meantime, the component current  $I_f$  was measured. The component current  $I_f$  increased with the resistance welding time, and amounted to 1.2mA after 15 minutes ( drawing 6 d). In addition, separately, when energized further, the current value was saturated.

[0163] (Process 6) Atmospheric air was introduced into : (stabilization process), next the vacuum processor of drawing 7 , and heat treatment was performed for 10 minutes at 410 degrees C under atmospheric pressure. In addition, since the conductive film was heated in atmospheric air, deformation of a particle etc. was not observed. Next, after performing evacuation and being referred to as ten to 6 Pa, hydrogen was introduced at the room temperature, reduction processing of the conductive film was performed, and resistance of the conductive film was reduced. In addition, in the following examples, especially, as long as there is no notice, it returns similarly. Then, the component current  $I_f$  of each surface conduction mold electron emission component of Substrate A and the emission current  $I_e$  were measured ( drawing 6 e).

[0164] The process of the substrate B of the [example 1 of a comparison], next the example 1 of a comparison is shown.

[0165] (Process 1) : (substrate washing / component electrode formation process) -- the process 1 of Substrate A -- the same .

[0166] (Process 2) the process 2 of the :(conductive film formation process) substrate A -- the same .

[0167] : (foaming process) (Process 3) There is no process 3 of Substrate A in Substrate B.

[0168] (Process 4) : (activation process), next an acetone were energized for 30 minutes after introducing into the vacuum processor of drawing 7 with the pressure of 10-2pa by the square wave pulse (driver voltage 15V,  $T_1=1\text{ms}$  of drawing 3 (a), and  $T_2=10\text{ms}$ ). In the meantime, the component current  $I_f$  was measured. The component current  $I_f$  was set to 2mA after 20 minutes.

[0169] (Process 5) With non-illustrated heating apparatus, after performing evacuation and being referred to as ten to 6 Pa, after heating Substrate B at 230 degrees C for 15 hours to : (stabilization process in the inside of a vacuum), next the vacuum processor of drawing 7 , it returned to the room temperature and the component current  $I_f$  of each surface conduction mold electron emission component of Substrate B and the emission current  $I_e$  were measured to them.

[0170] The Measuring condition was the same as that also of Substrates A and B, and the electrical potential difference of an anode electrode measured the distance H of 1kV, an anode electrode, and an electron emission component by 5mm and measurement component electrical-potential-difference 15V.

[0171] In Substrate B, the component current  $I_f$  was  $1.3\text{mA} \times 15\%$ , and the emission current  $I_e$  was  $1.0\text{micro A} \times 15\%$ . On the other hand, in Substrate A, the component current  $I_f$  was compared  $0.7\text{mA} \times 5\%$ , the emission current  $I_e$  was compared with  $0.95\text{micro A} \times 4.5\%$  and Substrate B, the emission current  $I_e$  was equivalent, the component current  $I_f$  decreased, and dispersion in a component property also decreased.

[0172] Then, although the emission current  $I_e$  decreased after fixed time amount in Substrate B under the above-mentioned Measuring condition after measurement of an above-mentioned property, and within measurement evaluation equipment at 56% of above-mentioned measured value when the continuation drive was performed, in Substrate A, it was 25% of reduction.

[0173] Next, Substrates A and B observed the electron emission section 3 by the electron microscope, Raman spectroscopy, etc.

[0174] The gestalt of the electron emission section 5 of the component of the substrates A and B observed with the electron microscope is shown in drawing 8 and drawing 21 . In addition, about the component of Substrate A, the component of drawing 8 and Substrate B was shown in drawing 21 . With the component of Substrate B, the coat was mainly especially formed in the high potential side from a part of electron emission section depending on the impression direction of the electrical potential difference to the component in (a process 4). It seemed that furthermore, this coat was formed also between the perimeter of a metal particle, and the particle if it observes for a high scale factor. On the other hand, with the component of Substrate A, carbon was mainly formed in the tip of the conductive film by the side of high potential especially from a part of electron emission section depending on the impression direction of the electrical potential difference to the component in (a process 5). It seemed that furthermore, this coat was formed also between the perimeter of a metal particle, and the particle if it observes for a high scale factor. Moreover, the carbon on the conductive film had less substrate A, and there was little distribution between components.

[0175] Furthermore, although the component of Substrate A consisted of graphite when observed by the transmission electron microscope and Raman spectroscopy, the component of Substrate B had a little low crystallinity of the carbon coat, and it became

clear that a part of hydrogen was contained.

[0176] In addition, although it was [ emission current / a component current and / this example ] few when it is not among a vacuum, the stabilization process of the (process 5) of the example 1 of a comparison was performed like the (process 6) of this example and measurement evaluation was performed, it became clear that the stabilization process of this invention was applicable. Moreover, the gestalt of a component was the same as that of the thing of drawing 8 .

[0177] [Example 2] this example is equivalent except for the process of the substrate A of an example 1, and process (4) - (6).

[0178] (Process 1) : (substrate washing / component electrode formation process) — the (process 1) of the substrate A of an example 1 — the same .

[0179] (Process 2) : (conductive film formation process) — the (process 2) of the substrate A of an example 1 — the same .

[0180] (Process 3) : (foaming process) — the (process 4) of the substrate A of an example 1 — the same .

[0181] (Process 4) With the spinner, after applying the prepolymerization object of the furfuryl alcohol beforehand created after picking out a substrate from : (organic material spreading process), next measurement evaluation equipment so that it may become the thickness of 25nm, it was BEKU and stiffened at 100 degrees C. in addition, this prepolymerization object — furfuryl alcohol (OHC:CHCH:CCH<sub>2</sub> OH) of 1% or less of moisture — toluenesulfonic acid — adding — 70-90-degree C constant temperature — it was under water bath, and heated, agitated and created.

[0182] (Process 5) : (carbonization process), next a substrate were again returned to measurement evaluation equipment, and it energized for 20 minutes, being a triangular wave pulse (driver voltage 15V, T1=2ms of drawing 3 (b), and T2=10ms) after evacuation, and reversing a high potential [ of a component electrode ], and low voltage side for every pulse to the degree of vacuum of ten to 5 Pa. In the meantime, the component current  $I_f$  was measured. The component current  $I_f$  increased with the resistance welding time, and the average of four components amounted to 1.4mA after 20 minutes.

[0183] (Process 6) : (stabilization process), next a substrate are divided into two, and this will be called A-1 and A-2 substrate.

[0184] A-1 substrate introduced atmospheric air into the vacuum processor of drawing 7 , and performed heat treatment for 20 minutes at 380 degrees C under atmospheric pressure. Next, after performing evacuation and being referred to as ten to 6 Pa, the component current  $I_f$  of each surface conduction mold electron emission component of Substrate A and the emission current  $I_e$  were measured.

[0185] On the other hand, in A-2 substrate, after performing evacuation and being referred to as ten to 6 Pa, after heating a substrate A-2 at 200 degrees C to the vacuum processor of drawing 7 for 15 hours, it returned to the room temperature and the component current  $I_f$  of each surface conduction mold electron emission component on a

substrate and the emission current  $I_e$  were measured with non-illustrated heating apparatus to it.

[0186] As for the Measuring condition, a substrate A-1 and A-2 were the same, and, as for the distance  $H$  of 1kV, an anode electrode, and an electron emission component, the electrical potential difference of an anode electrode measured them by 5mm and component electrical-potential-difference 15V. In the substrate A-2, the component current  $I_f$  was 1.2mA\*\*8%, and the emission current  $I_e$  was 1.0micro A\*\*8.5%. On the other hand, in the substrate A-1, the component current  $I_f$  was compared 0.8mA\*\*4.5%, the emission current  $I_e$  was compared with 0.95micro A\*\*4.5% and a substrate A-1, the discharge current  $I_e$  was equivalent, the component current  $I_f$  decreased, and dispersion in a component property also decreased.

[0187] Moreover, by the above-mentioned Measuring condition, the component electrical potential difference  $V_f$  was changed and the component electrical-potential-difference  $V_f$  dependency of the emission current  $I_e$  of a substrate A-1 and the component of A-2 and the component current  $I_f$  was investigated.

[0188] The component electrical-potential-difference  $V_f$  dependency of the emission current  $I_e$  and the component current  $I_f$  is shown in drawing 9 . The component current  $I_f$  and the emission current  $I_e$  show the property of the increment in monotone to the appearance shown in drawing 9 to the component electrical potential difference  $V_f$ . The emission current has a threshold electrical potential difference ( $V_{th}$ ), and it turns out that it increases above a threshold electrical potential difference. The component of a substrate A-2 is large compared with the component of A-1, and is the appearance which leakage current has generated in the component current  $I_f$ . In addition, leakage current is presumed to be the condition that a part of electron emission section connected too hastily electrically.

[0189] Then, after measurement of an above-mentioned property, and within measurement evaluation equipment, when the continuation drive was performed under the above-mentioned Measuring condition, the substrate A-1 and the component of A-2 were 15% of reduction.

[0190] Next, a substrate A-1 and A-2 observed the electron emission section 5 by the electron microscope, Raman spectroscopy, etc.

[0191] The gestalt of the electron emission section of the substrate A-1 observed with the electron microscope and the component of A-2 is shown in drawing 10 and drawing 22 . As the component of a substrate A-1 was shown in drawing 10 , the same carbon as the both sides by the side of low voltage and high potential was formed in a part for the point of the conductive film of the electron emission section 5. On the other hand, as the component of a substrate A-2 was shown in drawing 22 , the coat was formed on the electron emission section 5 and the conductive film to the both sides by the side of low voltage and high potential.

[0192] When the substrate A-1 and the component of A-2 were observed by the

transmission electron microscope and Raman spectroscopy, it mainly became clear to the electron emission section and near that it was glassy carbon. Moreover, with the component of a substrate A-2, the compound of carbon and hydrogen was in the part slightly. Here, that to which a microcrystal dimension is small, and glassy carbon is generally random layer structure, and has taken the non-orientation organization as a detailed organization is pointed out, and it is said that a high degree of hardness is generally taken. < -- < -- although the observation by Raman spectroscopy was measured using the 514.5nm oscillation line of an argon laser, the Raman line was observed by 1590-/cm and 1355-/cm, and the half-value width was also remarkably large in addition compared with HOPG (Raman line of 1581/cm of Highly Oriented Pyrolytic Graphite) of graphite structure. >>.

[Example 3] this example is an example which used the negative-mold electron beam resist. The substrate prepared two sheets, A and B, like the example 1. Moreover, from a process 1, since there are many the same parts as the process of an example 1, a process 5 is explained, referring to the production process Fig. of drawing 6 .

[0193] : (substrate washing / component electrode formation process) (Process 1) 30nm was deposited on Substrates A and B, respectively, using a mask as component electrodes 2 and 3, having used as the washing back with a detergent, pure water, and an organic solvent, and having fully used Pt as the component electrode material for the substrate 1 by the spatter. Then, vacuum deposition of the Cr film for lift off was further carried out by 100nm thickness for the purpose of patterning of the conductive film 2 ( drawing 6 a ).

[0194] Moreover, the component inter-electrode spacing L and the component electrode length W could be 10 micrometers and 100 micrometers, respectively.

[0195] : (conductive film formation process) (Process 2) The conductive film 4 was formed by depositing Pt in a spatter on the substrate in which the component electrodes 2 and 3 were formed. In this way, the thickness of the conductive film 4 which consists of a particle which consists of formed Pt is about 3nm, and sheet resistance is  $3 \times 10^4$ . They were  $\Omega/\square$ .

[0196] Wet etching of Cr film and the conductive film 4 after baking was carried out by etchant after that, and it formed in the desired pattern ( drawing 6 b ).

[0197] (Process 3) : (organic material spreading process), next the organic material used as the characteristic process of this invention are applied. At this example, after applying on a substrate as an organic material so that the conductive film 4 may be covered at least so that it may become the thickness of 40nm with a spinner about epoxidation 1 and 4-polybutadiene which are a negative-mold electron beam resist, it prebaked at 100 degrees C ( drawing 6 c ).

[0198] (Process 4) : (foaming process), then Substrate A were installed in the vacuum processor of drawing 7 , after evacuation, the pulse-like electrical potential difference by the non-illustrated power source was impressed between the component electrode 2 and

3, and foaming energization processing was performed ( drawing 6 d).

[0199] In addition, the foaming voltage waveform was the square wave of 10 mses about 1 ms and pulse separation T2 in pulse width T1, and it was performed under the 10–5Pa vacuum ambient atmosphere, making a pulse height value increase gradually.

[0200] (Process 5) It energized for 12 minutes with the degree of vacuum of ten to 5 Pa by the square wave pulse (: (carbonization process) next driver voltage 15V, T1=1ms of drawing 3 (a), and T2=10ms). In the meantime, the component current If was measured. Although it increased with the resistance welding time and the component of Substrates A and B amounted to 1.5mA after 12 minutes, although it continued energizing the component current If for 10 minutes, its component current If was almost more fixed still.

[0201] (Process 6) : (stabilization process), next Substrate A introduced atmospheric air into the vacuum processor of drawing 7 , and performed heat treatment for 20 minutes at 400 degrees C under atmospheric pressure. Next, after performing evacuation and being referred to as ten to 6 Pa, the component current If of each surface conduction mold electron emission component of Substrate A and the emission current Ie were measured.

[0202] On the other hand, in the vacuum processor of drawing 7 , Substrate B is the degree of vacuum of ten to 5 Pa, and performed 200 degrees C and 15-hour heat treatment. Next, after performing evacuation and being referred to as ten to 6 Pa, the component current If of each surface conduction mold electron emission component of Substrate B and the emission current Ie were measured.

[0203] The Measuring condition was the same and the electrical potential difference of an anode electrode measured the distance H of 1kV, an anode electrode, and an electron emission component by 5mm and measurement component electrical–potential–difference 15V.

[0204] The component current If of the component of Substrate A was 0.8mA\*\*4.5%, and the emission current Ie was the property that 0.9mA\*\*4.7% and the emission current Ie of 1.0micro A\*\*4.5% and the component current If of the component of Substrate B are almost equivalent to 1.0micro A\*\*4.9%.

[0205] Then, except having set the electrical potential difference of an anode electrode to 10kV after measurement of an above–mentioned property, and within measurement evaluation equipment, when the continuation drive was performed under the above–mentioned Measuring condition, the component of Substrates A and B was 23% of reduction on the average. Moreover, discharge was not generated in said drive time amount at this time.

[0206] On the other hand, in the case of the substrate B of an example 1, there was a case where generating of discharge took place. Moreover, in the component of Substrate B, like Substrate A, in the case of a negative–mold electron beam resist, it will be thought of for not a decomposition reaction but a polymerization and a carbonization process to advance that discharge does not occur, even if nearly perfect carbonization takes place, and gas etc. does not occur during a drive or an intermediate product has an electron ray



during a drive, when sufficient carbonization process is taken. It is thought of with since the intermediate product fully formed at the activation process is not removed that discharge occurred on the other hand in the example of a comparison of the example 1 which is a stabilization process using the same vacuum.

[0207] Next, Substrates A and B observed the electron emission section 5 by the electron microscope, Raman spectroscopy, etc.

[0208] The gestalt of the electron emission section 5 observed with the electron microscope was the same as that of drawing 8 of an example 1 about Substrate A. Moreover, about Substrate B, it was the same as that of drawing 21 .

[0209] Furthermore, although the coat mainly consisted of graphite when observed by the transmission electron microscope and Raman spectroscopy, it became clear that it was the same crystallinity as an example 1.

[0210] [Example 4] this example is almost the same as the production process of an example 3. However, the substrate was made into one sheet.

[0211] (Process 1) : (the substrate washing approach / component electrode formation process) -- the process 1 of an example 3 -- the same .

[0212] (Process 2) : (conductive film formation process) -- the process 2 of an example 3 -- the same .

[0213] (Process 3) After applying with a spinner : (organic material spreading process), next the glycidyl methacrylate-ethyl-acrylate copolymer which is a negative-mold electron beam resist so that it may become the thickness of 35nm, it was prebaked at 90 degrees C.

[0214] (Process 4) : (foaming process) -- the process 4 of an example 3 -- the same .

[0215] (Process 5) : (carbonization process), next a substrate were again returned to measurement evaluation equipment, it was a square wave pulse (driver voltage 15V,  $T_1=1.5\text{ms}$  of drawing 3 (a), and  $T_2=10\text{ms}$ ) after evacuation to the degree of vacuum of ten to 5 Pa, and it energized for 15 minutes, reversing a high potential [ of a component electrode ], and low voltage side for every pulse. In the meantime, the component current  $I_f$  was measured. The component current  $I_f$  increased with the resistance welding time, and the average of four components amounted to 1.6mA after 15 minutes.

[0216] : (stabilization process) (Process 6) It is the same as the process 6 of an example 3.

[0217] Like other examples, the Measuring condition was the same and the electrical potential difference of an anode electrode measured the distance H of 1kV, an anode electrode, and an electron emission component by 5mm and measurement component electrical-potential-difference 15V.

[0218] The component current  $I_f$  was compared  $0.8\text{mA} \times 4.5\%$ , the emission current  $I_e$  was compared with  $A \times 4.5\%$  and the example 1 of a comparison of an example 1 of 1.0micro, the emission current  $I_e$  was equivalent, the component current  $I_f$  decreased, and dispersion in a component property also decreased.

[0219] Then, when the continuation drive was performed under above-mentioned conditions after measurement of an above-mentioned property, and within measurement evaluation equipment, all four components of the emission current  $I_e$  were 25% or less of reduction. This is equivalent to the substrate A of an example 1.

[0220] Next, the electron emission section 3 was observed by the electron microscope, Raman spectroscopy, etc.

[0221] Carbon was formed in the both sides by the side of low voltage and high potential by the gestalt of the electron emission section of the component observed with the electron microscope like the gestalt of drawing 10 at a part for the point of the conductive film of the electron emission section 5. Furthermore, although the coat mainly consisted of graphite when observed by the transmission electron microscope and Raman spectroscopy, it became clear that it was crystallinity like an example 1.

[0222] Since [example 5] this example is the same, removing a process 5 and a process 6 in the substrate A of an example 1, an ingredient, and a process, other processes are skipped.

[0223] : (carbonization process), next a substrate are again returned to measurement evaluation equipment. (Process 5) To the degree of vacuum of ten to 5 Pa Irradiate in the shape of a pulse, and, carrying out local heating of the laser light near the electron emission section from the aperture of measurement evaluation equipment after evacuation by the triangular wave pulse (driver voltage 15V,  $T_1=0.3\text{ms}$  of drawing 3 (b), and  $T_2=10\text{ms}$ ) And the component current was 1.2mA when energized for 10 minutes, reversing a high potential [ of a component electrode ], and low voltage side for every pulse. It is considered to have been performed by total energy as it was mentioned above from the component current  $I_f$  having increased satisfactory, although  $T_1$  was shortened since it added heating by laser. In addition, when the temperature rise of the conductive film by laser light was measured separately, it was 200 degrees C.

[0224] (Process 6) It is  $\text{N}_2$  and 20% $\text{O}_2$  80% to : (stabilization process), next the vacuum processor of drawing 7 . After carrying out 10–1Pa installation of the gas at measurement evaluation equipment, heat treatment was performed for 20 minutes at 440 degrees C. In addition, although it wrote as the bottom of reduced pressure and heat treatment temperature was made high a little, it was satisfactory also from the result of an electrical property and observation. Next, after performing evacuation and being referred to as ten to 6 Pa, the component current  $I_f$  of each surface conduction mold electron emission component and the emission current  $I_e$  were measured. Like other examples, the Measuring condition was the same and the electrical potential difference of an anode electrode measured the distance H of 1kV, an anode electrode, and an electron emission component by 5mm and measurement component electrical-potential-difference 15V.

[0225] The component current  $I_f$  was compared 0.9mA\*\*5.5%, the emission current  $I_e$  was compared with A\*\*5.2% and the example 1 of a comparison of an example 1 of 0.9micro, the emission current  $I_e$  was equivalent, the component current  $I_f$  decreased, and

dispersion in a component property also decreased.

[0226] Then, when the continuation drive was performed under the above-mentioned Measuring condition after measurement of an above-mentioned property, and within measurement evaluation equipment, all four components of the emission current  $I_e$  were 25% or less of reduction. This is equivalent to the substrate A of an example 1.

[0227] Next, the electron emission section 5 was observed by the electron microscope, Raman spectroscopy, etc.

[0228] As for the gestalt of the electron emission section of the component observed with the electron microscope, carbon was formed at the tip of the conductive film of the electron emission section like drawing 10 to the both sides by the side of low voltage and high potential, respectively. Furthermore, although the coat mainly consisted of graphite when observed by the transmission electron microscope and Raman spectroscopy, it became clear that it was the same crystallinity as an example 1.

[0229] [Example 6] this example is equivalent except for the process of examples 1 and 2, and the formation process of the conductive film.

[0230] (Process 1) : (substrate washing / component electrode formation process) -- the (process 1) of the substrate A of an example 1 -- the same .

[0231] : (conductive film formation process) (Process 2) Between the component electrodes 2 and the component electrodes 3 which were formed on the substrate 1, it formed suitably as a catalyst nature metal by the thickness which took W into consideration as Pt, nickel, and an example of a comparison, and took foaming into consideration by the spatter as a non-catalyst nature metal. others -- the (process 2) of the substrate A of an example 1 -- the same .

[0232] (Process 3) : (organic material spreading process) -- the (process 3) of the substrate A of an example 1 -- the same .

[0233] (Process 4) : (foaming process) -- the (process 4) of the substrate A of an example 1 -- the same .

[0234] (Process 5) : (carbonization process) -- the (process 5) of an example 2 -- the same .

[0235] (Process 6) : (stabilization process) -- the (process 6) of an example 2 -- the same .

[0236] In this way, measurement and the electron emission section were similarly observed for the created component by the Measuring condition of an example 2, respectively. A measurement result and the observation result of the electron emission section are shown in Table 1.

[0237] Although, as for the component using the non-catalyst nature metal W, glassy carbon is formed compared with the component using the catalyst nature metals Pt and nickel as conductive film to the both sides for a point of the conductive film by the side of the electron emission section 5, low voltage, and high potential, it exists in the direction of electron emission length partially, and it is the effect and both the component current  $I_f$

and the emission current  $I_e$  are presumed to be small, so that more clearly than Table 1. <  
-- in addition, the direction of electron emission length is the direction of W of drawing 1  
here. >.

[0238]

[Table 1]

表 1 : 各種導電性膜材料での電子放出部の観察結果

| 導電性<br>薄膜材料 | 電子放出特性   | 電子放出部の観察結果                                 |
|-------------|--|--|
| P t         | 素子電流 $I_f = 0.75 \text{ mA}$<br>放出電流 $I_e = 1.0 \mu\text{A}$ | 電子放出部 5 の導電性薄膜の先端部分に、低電位側、高電位側の双方にガラス状炭素   |
| N i         | 素子電流 $I_f = 0.8 \text{ mA}$<br>放出電流 $I_e = 1.1 \mu\text{A}$  | 電子放出部 5 の導電性薄膜の先端部分に、低電位側、高電位側の双方にガラス状炭素   |
| 比較例<br>W    | 素子電流 $I_f = 0.6 \text{ mA}$<br>放出電流 $I_e = 0.5 \mu\text{A}$  | 電子放出部 5、低電位側、高電位側の導電性薄膜の先端部分の双方に部分的にガラス状炭素 |

[Example 7] this example is an example which constituted the image formation equipment which carried out matrix arrangement of many surface conduction mold electron emission components of this invention of an example 1 simply, and is an example which constituted the so-called color flat display.

[0239] Some top views of an electron source are shown in drawing 11. Moreover, the A-A' sectional view in drawing is shown in drawing 12. Moreover, the manufacture approach is shown in drawing 13 - drawing 15. However, in drawing 11, drawing 12, drawing 13, and drawing 15, what was shown with the same notation shows the same thing. For the direction wiring (it is also called upper wiring) of Y corresponding to Dyn in the direction wiring of X corresponding to Dxn in 112 corresponding to a substrate in 1 (it is also called bottom wiring), and 113, and 4, as for a component electrode and 121, in drawing, the conductive film, and 2 and 3 are [ a layer insulation layer and 122 ] the contact holes for the electrical installation of the component electrode 2 and the bottom wiring 112.

[0240] Next, the manufacture approach is concretely explained according to the order of a process of (a) - (i) shown in drawing 13 - drawing 15.

[0241] : ((a) Process) On the substrate 1 which formed silicon oxide with a thickness of 0.5 microns by the spatter on the defecated blue plate glass After BEKU [ carrying out the laminating of Cr with a thickness of 5nm and the Au with a thickness of 600nm one by one with vacuum deposition and / it / with a spinner / rotation-applying a photoresist

(AZ1370 Hoechst A.G. make) and ], a photo mask image is exposed and developed. The resist pattern of the bottom wiring 112 is formed, wet etching of the Au/Cr deposition film is carried out, and the wiring 112 under a desired configuration is formed.

[0242] ((b) Process) The layer insulation layer 121 which consists of :, next silicon oxide with a thickness of 1.0 micrometers is deposited by RF sputter.

[0243] ((c) Process) The photoresist pattern for forming a contact hole 122 in :, next the silicon oxide deposited at Process b is made, it etches layer insulation layer 121 by making this into a mask, and a contact hole 122 is formed. Etching is CF<sub>4</sub>. H<sub>2</sub> It was based on the RIE (Reactive Ion Etching) method using gas.

[0244] : ((d) Process) After that, photoresist formation of the pattern which should serve as the component electrodes 2 and 3 and the component inter-electrode gap L was carried out, and the sequential deposition of Ti with a thickness of 5nm and the nickel with a thickness of 40nm was carried out with the vacuum deposition method. After dissolving the photoresist by the organic solvent and carrying out lift off of the nickel/Ti deposition film, except for the component electrode 3, it covered by the photoresist, and further, 100nm of nickel was deposited and thickness of the component electrode 3 was set to 140nm. The component electrode spacing L formed the component electrodes 2 and 3 which set to 5 micrometers and set width of face W of a component electrode to 200 micrometers.

[0245] ((e) Process) After forming the photoresist pattern of the upper wiring 113 on :, next the component electrodes 2 and 3, Ti with a thickness of 5nm and Au with a thickness of 500nm were deposited with vacuum deposition one by one, lift off removed the unnecessary part, and the upper wiring 113 of a desired configuration was formed.

[0246] ((f) Process) Cr film of 100nm of thickness was carried out deposition and patterning vacuum deposition with the mask which has opening in : next electrode gap between components L, and this near, and heating baking processing for 12 minutes was carried out for organic [ Pd ] (ccp4230 Okuno Pharmaceuticals company make) at rotation spreading and 300 degrees C with the spinner on it. Moreover, the thickness of the thin film 4 for electron emission section formation which consists of a particle which was formed in this way, and which mainly consists of PdO is 7nm, and sheet resistance is  $2 \times 10^4$ . They were  $\omega$ /\*\*.

[0247] ((g) Process) With the spinner, after applying :, next the prepolymerization object 131 of furfuryl alcohol created beforehand so that it may become the thickness of 20nm, it was BEKU and stiffened at 100 degrees C.

[0248] : ((h) Process) Cr film and the thin film 4 for electron emission section formation after baking were etched by acid etchant, and the desired pattern was formed.

[0249] : ((i) Process) A pattern which applies a resist in addition to contact hole 122 part was formed, and the sequential deposition of Ti with a thickness of 5nm and the Au with a thickness of 500nm was carried out with vacuum deposition. The contact hole 122 was embedded by removing an unnecessary part by lift off.

[0250] : ((j) Process) Foaming was performed for every Rhine after evacuation up to ten to 4 Pa by the manufacturing installation which can supply an electrical potential difference for a substrate to each component from each wiring Dxn and Dym with the same configuration as measurement evaluation equipment. The conditions of foaming are the same as an example 2.

[0251] : ((k) Process) It energized for 12 minutes for every Rhine on the same drive conditions as an example 3. Energization was finished, when the component current  $I_f$  was measured and the component current  $I_f$  per element of each Rhine reached 1.3mA in the meantime.

[0252] : ((l) Process) The substrate finished to Process k is taken out from the above-mentioned manufacturing installation, and it is N<sub>2</sub> and 20%O<sub>2</sub> 80%. The clean oven which carried out 10-1Pa installation of the gas performed baking for 10 minutes at 420 degrees C.

[0253] Electron sources, such as the electron emission characteristic, were inspected with the test equipment using the drive circuit which mentions the created electron source substrate later according to the above process. In this inspection process, what the final inspection of an electron source substrate was conducted and passed inspection is moved like the assembler of the image formation equipment mentioned later.

[0254] Next, the face shield was formed. The fluorescent screen and the metal back by whom the fluorescent substance has been arranged are formed in the inside of a glass substrate, and a face shield is constituted. In the case of monochrome, a fluorescent screen can consist of only fluorescent substances. In the case of the fluorescent screen of a color, it can constitute from the black electric conduction material and fluorescent substance which are called a black stripe or a black matrix by the array of a fluorescent substance. In the case of color display, the purpose which establishes a black stripe and a black matrix is to control [ it not being conspicuous and carrying out color mixture etc. by distinguishing by different color between each fluorescent substance of a needed three-primary-colors fluorescent substance with, and making the section black, and ] the fall of the contrast by the outdoor daylight reflection in a fluorescent screen. There is conductivity besides the ingredient which uses the graphite usually used as a principal component as an ingredient of a black stripe, and an ingredient with little transparency of light and reflection can be used.

[0255] The approach of applying a fluorescent substance to a glass substrate is not based on monochrome and a color, but a precipitation method, print processes, etc. can be used for it. The metal back is usually prepared in the inside side of a fluorescent screen. The purposes which prepare the metal back are making it act as an electrode for impressing raising brightness and electron beam acceleration voltage, protecting a fluorescent substance from the damage by the collision of the anion generated within the envelope, etc. by carrying out specular reflection of the light by the side of an inside to a face shield side among luminescence of a fluorescent substance. The metal back performs data

smoothing (usually called "filming".) of the inside side front face of a fluorescent screen after fluorescent screen production, and it can produce by making aluminum deposit using vacuum deposition etc. after that. Moreover, in order to raise the conductivity of a fluorescent screen to a face shield further, a transparent electrode may be prepared in the external surface side of a fluorescent screen.

[0256] In this way, in this example, the face shield with a SUTORAIBU-like fluorescent screen was formed.

[0257] The display shown in drawing 16 below using the electron source substrate and face shield which were produced as mentioned above was assembled.

[0258] In drawing 16, 110 is an electron emission component and 112,113 is component wiring of the direction of X, and the direction of Y, respectively.

[0259] After fixing the substrate 1 which produced many surface conduction mold electron emission components on the rear plate 141, To 5mm upper part of a substrate 1, a face shield 144 (the fluorescent screen 148 and the metal back 149 by whom the fluorescent substance of a stripe configuration has been arranged are formed and constituted by the inside of a glass substrate 147) is arranged through a housing 146. Applied frit glass to the joint of a face shield 144, a housing 146, and the rear plate 145, each color fluorescent substance and electron emission component of a color were made to correspond, sufficient alignment was performed, and it sealed by calcinating at 400 degrees C in atmospheric air next for 15 minutes. In addition, an envelope consists of a face shield 144, a housing 146, and a rear plate 145 like \*\*\*\*. Since it is prepared in order to mainly reinforce the reinforcement of a substrate 1, the rear plate 145 can be made unnecessary [ the rear plate 145 of another object ] when it has reinforcement sufficient by substrate 1 the very thing. That is, the direct housing 146 is sealed in a substrate 1, and an envelope may consist of a face shield 144, a housing 146, and a substrate 1. The envelope which has sufficient reinforcement to atmospheric pressure by installing the base material which is not illustrated [ which is called a spacer ] between a face shield 144 and the rear plate 145 on the other hand can also be constituted.

[0260] Then, in order to remove the water contained in the member which exhausts the ambient atmosphere in glassware up to ten to 5 Pa with a vacuum pump through an exhaust pipe (not shown), and constitutes a container, oxygen, CO and CO<sub>2</sub>, hydrogen, etc. After exhausting heating at 150 degrees C for 2 hours, in order to maintain the degree of vacuum after the closure, getter processing was performed by the high-frequency-induction-heating method, it welded by heating a non-illustrated exhaust pipe with a gas burner, and the closure of an envelope was performed. In addition, at this example, since the water which what is removed at a stabilization process can mainly remove at low temperature, oxygen, CO and CO<sub>2</sub>, and hydrogen were objects, baking was performed in low temperature and a short time.

[0261] The example of a configuration of the drive circuit for performing the television display based on the TV signal of NTSC system is explained to the display panel

constituted using the electron source of the simple matrix arrangement created as mentioned above using drawing 17 .

[0262] For 151, as for a scanning circuit and 153, in drawing 17 , an image display panel and 152 are [ a control circuit and 154 ] shift registers. For 155, the Rhine memory and 156 are [ a modulating-signal generator and Vx and Va of a synchronizing signal separation circuit and 157 ] direct current voltage supplies.

[0263] The display panel 151 is connected with the external electrical circuit through a terminal Dox1 thru/or Doxm, a terminal Doy1 or Doyn, and a secondary terminal Hv. The scan signal for carrying out the party [ every ] (N component) sequential drive of the surface conduction mold electron emission elements by which matrix wiring was carried out is impressed at Terminal Doxm to the electron source established in the display panel, i.e., the letter of a matrix of a M line N train.

[0264] The modulating signal for controlling the output electron beam of each component a party's surface conduction mold electron emission component chosen by said scan signal is impressed to a terminal Dy1 thru/or Dyn. Although the direct current voltage of 10k [V] is supplied to a secondary terminal Hv from direct current voltage supply Va, this is the acceleration voltage for giving sufficient energy exciting a fluorescent substance to the electron beam emitted from a surface conduction mold electron emission component.

[0265] A scanning circuit 152 is explained. Inside, this circuit is the thing equipped with M switching elements (S1 thru/or Sm show typically among drawing), and is located. Each switching element chooses the output voltage of direct current voltage supply Vx, or either of 0 [V] (grand level), and is electrically connected with the terminal Dox1 of a display panel 151 thru/or Doxm. Each switching element of S1 thru/or Sm can operate based on the control signal Tscan which a control circuit 153 outputs, and can be constituted by combining a switching element like FET for example.

[0266] In this example, direct current voltage supply Vx are set up so that a fixed electrical potential difference which the driver voltage impressed to the component which is not scanned based on the property (electron emission threshold electrical potential difference) of a surface conduction mold electron emission component turns into below an electron emission threshold electrical potential difference may be outputted.

[0267] A control circuit 153 has the function to adjust actuation of each part so that a suitable display may be performed based on the picture signal inputted from the exterior. A control circuit 153 generates each signal of Tscan, Tsft, and Tmry to each part based on the synchronizing signal Tsync sent from the synchronizing signal separation circuit 156.

[0268] The synchronizing signal separation circuit 156 is a circuit for separating a synchronizing signal component and a luminance-signal component from the TV signal of the NTSC system inputted from the outside, and can be constituted using a general frequency-separation (filter) circuit etc. The synchronizing signal separated by the synchronizing signal separation circuit 156 was illustrated as after [ expedient / Tsync ]



explaining here, although it consisted of the Vertical Synchronizing signal and the Horizontal Synchronizing signal. The luminance-signal component of the image separated from said TV signal was expressed as the DATA signal for convenience. This DATA signal is inputted into a shift register 154.

[0269] it operates based on the control signal Tsft which a shift register 154 is for carrying out serial/parallel conversion of said DATA signal inputted serially for every line of an image, and is sent from said control circuit 153 (namely, -- a control signal Tsft is the shift lock of a shift register 154 -- also saying -- it can do.). The data for the image of one line by which serial/parallel conversion was carried out (equivalent to the drive data for an electron emission component N component) are outputted from said shift register 154 as a parallel signal of Id1 thru/or N individual of Idn.

[0270] The Rhine memory 155 is storage for between need time amount to memorize the data for the image of one line, and memorizes the contents of Id1 thru/or Idn suitably according to the control signal Tmry sent from a control circuit 153. The memorized contents are outputted as I'd1 thru/or I'dn, and are inputted into the modulating-signal generator 157.

[0271] The modulating-signal generator 157 is a source of a signal for carrying out the drive modulation of each of a surface conduction mold electron emission component appropriately according to each of image data I'd1 thru/or I'dn, and the output signal is impressed to the surface conduction mold electron emission component in a display panel 151 through a terminal Doy1 thru/or Doyn.

[0272] Here, it became irregular by pulse width modulation. It faces carrying out pulse width modulation and the circuit of pulse width modulation which generates the electrical-potential-difference pulse of fixed peak value as a modulating-signal generator 157, and modulates the width of face of an electrical-potential-difference pulse suitably according to the data inputted can be used.

[0273] As for a shift register 154 or the Rhine memory 155, the thing of an analog signal type can also adopt the thing of a digital signal type. It is because serial/parallel conversion and storage of a picture signal should just be performed at the rate of predetermined.

[0274] By such drive actuation, electron emission arises by impressing an electrical potential difference to each electron emission component of a display panel through the container outer edge child Dox1 thru/or Doxm, Doy1, or Doyn. High pressure is impressed to the metal back 149 through a secondary terminal Hv, and an electron beam is accelerated. The accelerated electron collides with a fluorescent screen 148, luminescence produces it, and an image is formed.

[0275] In the image formation equipment of this invention completed as mentioned above, when the NTSC signal was inputted, the television picture was displayed.

[0276] Especially [example 8] this examples are the manufacture approach of a display panel, and an example of equipment in the manufacture approach of the image formation

equipment of an example 7. Moreover, in this example, a rear plate is the example as which it served with the electron source substrate. Hereafter, it explains using the process flow Fig. of drawing 18 , and the equipment mimetic diagram of drawing 19 .

[0277] First, equipment is explained.

[0278] The manufacturing installation of a display panel consists of load lock system vacuum chambers. It consists of a (rear plate load room), a (rear plate baking room), (foaming and a carbonization room), (stabilization and a sealing room), a (face shield load room), a (face shield baking room), and a (annealing room), each chamber has divided between chambers and can hold a vacuum independently between each chamber, and a substrate is conveyed by the following chamber after finishing the process in each chamber. A rear plate is thrown in from a (rear plate load room), to stabilization and a sealing room, performs each process and is conveyed. On the other hand, a face shield is thrown in from a (face shield load room), it is conveyed through a (face shield baking room) at the above-mentioned (above-mentioned stabilization and sealing room), and a display panel is assembled on the rear plate which finished the stabilization process. The container assembled at the end is conveyed at an annealing room, and is annealed to a room temperature. The exhaust air system which consists of vacuum pumps of each \*\* and an oil free-lancer is attached. Moreover, at (foaming and a carbonization room), not only each electrical treatment but electric inspection can be conducted. The gas for stabilizing can be introduced now into stabilization and a sealing room.

[0279] Next, the manufacture approach is explained.

[0280] Inspection was conducted after creation like the creation process (process 1) (creation and inspection of face shield) example 7 of a face shield.

[0281] Under the present circumstances, the housing was pasted up on the periphery section of a face shield with frit glass. Moreover, the sheet frit has been arranged to jointing with the rear plate of a housing. In addition, the rear plate which finished the process 1 is thrown into the load room of the equipment of drawing 19 . At a load room, two or more rear plates are saved in a vacuum.

[0282] (Process 2) It is a process except the water by which the face shield was adsorbed, oxygen CO and CO<sub>2</sub>, hydrogen, etc., and baked in the vacuum at 400 degrees C for 10 minutes (baking of a face shield). In addition, in order to arrange the rear plate and temperature of (a process 6), it held at 400 degrees C. In addition, the degree of vacuum in equipment was  $1 \times 10^{-5}$  Pa.

[0283] the process of creation process (process 3) (formation of rear plate (this example electron source substrate)) example [ of a rear plate ] 7 (a) - (i) -- the same .

[0284] It is in the condition that the laminating of the conductive film and the organic material was carried out to the component inter-electrode connected to passive-matrix wiring on the electron source substrate at this process. In addition, the rear plate which finished the process 1 is thrown into the load room of the equipment of drawing 19 . A load room saves two or more rear plates in a vacuum.

[0285] : (rear plate baking) (Process 4) It is a process except the water by which the rear plate was adsorbed, oxygen, CO and CO<sub>2</sub>, hydrogen, etc., and baked in the vacuum at 200 degrees C for 1 hour. In addition, the degree of vacuum in equipment was  $1 \times 10^{-5}$  Pa.

[0286] (Process 5) Foaming was first performed like the example 7 (foaming, carbonization process). It continued and the carbonization process was performed. In addition, this process was performed within the same chamber. Moreover, the substrate was made into 200 degrees C with whole heating. Moreover, inspection of a component current was conducted after carbonization process termination, and it considered as inspection of an electron source substrate here.

[0287] : (stabilization, sealing process) (Process 6) The mixed gas of oxygen / N<sub>2</sub> = 1:4 was introduced by 1Pa, and it carried out for heating 10 minutes at 440 degrees C. Moreover, this temperature was held. Next, the face shield which finished (the process 2) was conveyed in (stabilization and a sealing room), and the rear plate and the face shield were pasted up, pressurizing by performing alignment of a face shield and a rear plate. < - in addition, in order to remove the binder which remains to a frit, it was made to remain also at the time of sealing, but introductory gas was sealed, when it exhausted after that and chamber internal pressure was set to ten to 7 Pa. >.

[0288] (Process 7) After annealing the display panel formed at the process 6 to a room temperature, it was taken out from the annealing room here (annealing process).

[0289] (Process 8) Here, in order to maintain the degree of vacuum in a display panel, the flash plate of the getter was carried out.

[0290] (Process 9) Electric inspection of the display panel created in this way was carried out.

[0291] (Process 10) Next, the excellent article in a process 9 was mounted for the drive circuit of an example 7 etc., and image formation equipment was created.

[0292] In this way, by the created image formation equipment, when image display was performed like the example 7, image display was carried out.

[0293]

[Effect of the Invention] Since it had the activation process which was explained above and which consists of the spreading process and carbonization process of an organic material in the manufacture approach of an electron emission component like according to this invention, the surface conduction mold electron emission component which has the stable property excellent in the electron emission characteristic was able to be created at the easy process. Furthermore, if a catalyst nature metal is used, much more good carbon can be formed.

[0294] Moreover, since it is performed after the stabilization process of the electron emission component of this invention of heating in reactant gas performs said activation process, and the difference of the resistance over the reactant gas between the intermediate product in said activation process and a carbonization object is used, an intermediate product is easily removed at low temperature, and saves the property of the

surface conduction mold electron emission component moreover remarkably improved at the activation process. Therefore, the above-mentioned trouble in the conventional stabilization process is solved, and suppression of discharge and stabilization of the electron emission characteristic are made.

[0295] Therefore, in the electron source which arranged two or more electron emission components, or image formation equipment, since control is an easy activation process compared with the controllability of the conventional activation process, dispersion in the property etc. is controlled.

[0296] Moreover, since only the excellent article with which the electron source and the face shield were inspected can perform the assembly of a back process according to the manufacture approach of the image formation equipment of this invention of having the process which assembles a vacuum envelope with the production process of an electron source substrate, its inspection, the production process of a face shield, its inspection, an electron source substrate, and the face shield that has an image formation member, image formation equipment can be manufactured cheaply.

[0297] Moreover, since the intermediate product produced at the activation process is removed and removal of water, oxygen, CO and CO<sub>2</sub>, hydrogen, etc. serves as a subject from an electron source substrate beforehand in the process which seals and assembles the face shield which has the substrate of an electron source, and a fluorescent substance, stable image formation equipment can be manufactured easily.

[0298] the manufacture approach of above-mentioned image formation equipment -- < -- the water to each part material which carried out degasifying, oxygen, hydrogen, and CO and CO<sub>2</sub> etc. -- the high image formation equipment of the yield has been realized to > stability like by considering as the consistent manufacturing installation without contamination by re-adsorption, without taking out the whole manufacture of image formation equipment in atmospheric air for every process.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the typical top view (a) and typical sectional view (b) showing the configuration of the surface conduction mold electron emission component of this invention.

[Drawing 2] It is the manufacture flow Fig. showing the manufacture approach of the surface conduction mold electron emission component of this invention.

[Drawing 3] It is the mimetic diagram showing an example of the voltage waveform used for the activation process at the time of manufacture of the surface conduction mold electron emission component of this invention.

[Drawing 4] It is drawing showing the principle of the stabilization process of the

manufacture approach of this invention, and is drawing showing the relation of the conversion of the intermediate product of an organic material, a carbonization object, and reactant gas.

[Drawing 5] It is the manufacture flow Fig. showing an example of the manufacture approach of the image formation equipment of this invention.

[Drawing 6] It is the production process Fig. of an example 1.

[Drawing 7] It is the mimetic diagram showing an example of the vacuum processor equipped with the measurement evaluation function.

[Drawing 8] It is the mimetic diagram showing the structure of the surface conduction mold electron emission component formed in the example 1.

[Drawing 9] It is the graph which shows an example of the relation between the emission current  $I_e$  about the surface conduction mold electron emission component of an example 2, the component current  $I_f$ , and the component electrical potential difference  $V_f$ .

[Drawing 10] It is the mimetic diagram showing the structure of the surface conduction mold electron emission component formed in the example 2.

[Drawing 11] It is the top view showing an example of the electron source which can apply this invention in an example 6, and which carried out passive-matrix arrangement.

[Drawing 12] It is the sectional view showing an example of the electron source which can apply this invention in an example 6, and which carried out passive-matrix arrangement.

[Drawing 13] It is the production process Fig. of an example 6.

[Drawing 14] It is the production process Fig. of an example 6.

[Drawing 15] It is the production process Fig. of an example 6.

[Drawing 16] It is the mimetic diagram showing an example of the display panel of the image formation equipment which can apply this invention.

[Drawing 17] It is the block diagram showing an example of the drive circuit for displaying on image formation equipment according to the TV signal of NTSC system.

[Drawing 18] It is the manufacture flow Fig. of the image formation equipment in an example 8.

[Drawing 19] It is the mimetic diagram of the manufacturing installation used in the example 8.

[Drawing 20] It is the mimetic diagram showing an example of the conventional surface conduction mold electron emission component.

[Drawing 21] It is the mimetic diagram showing the structure of the surface conduction mold electron emission component of the example of a comparison formed in the example 1.

[Drawing 22] It is the mimetic diagram showing the structure of the surface conduction mold electron emission component of the example of a comparison formed in the example 2.

[Description of Notations]

1 Substrate

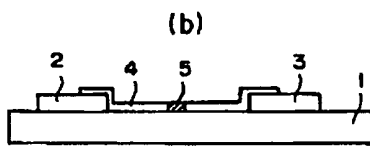
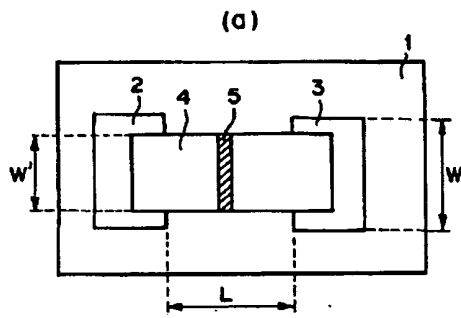
2 Three Component electrode  
4 Conductive Film  
5 Electron Emission Section  
70 Ammeter for Measuring Component Current If Which Flows Component Electrode 2  
and Conductive Film 4 between Three  
71 Power Source for Impressing Component Electrical Potential Difference  $V_f$  to Electron  
Emission Component  
72 Ammeter for Measuring Emission Current  $I_e$  Emitted from Electron Emission Section 5  
of Component  
73 High Voltage Power Supply for Impressing Electrical Potential Difference to Anode  
Electrode 74  
74 Anode Electrode for Catching Emission Current  $I_e$  Emitted from Electron Emission  
Section of Component  
75 Vacuum Devices  
76 Exhaust Air Pump  
77 Bomb of Gas for Stable Chemically-modified Degrees  
78 Ampul for Activation Processes  
112 The Direction Wiring of X (Bottom Wiring)  
113 The Direction Wiring of Y (Upper Wiring)  
110 Surface Conduction Mold Electron Emission Component  
141 Face Shield  
145 Rear Plate

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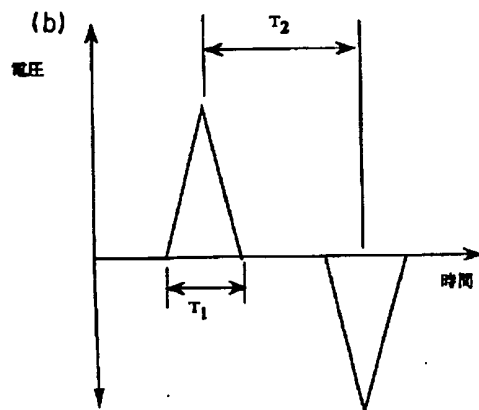
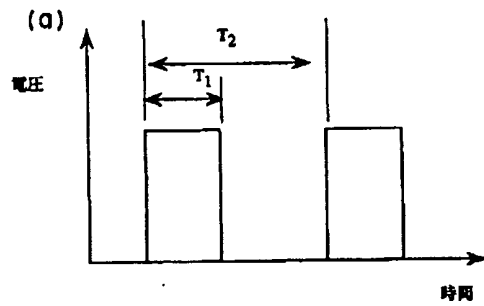
## DRAWINGS

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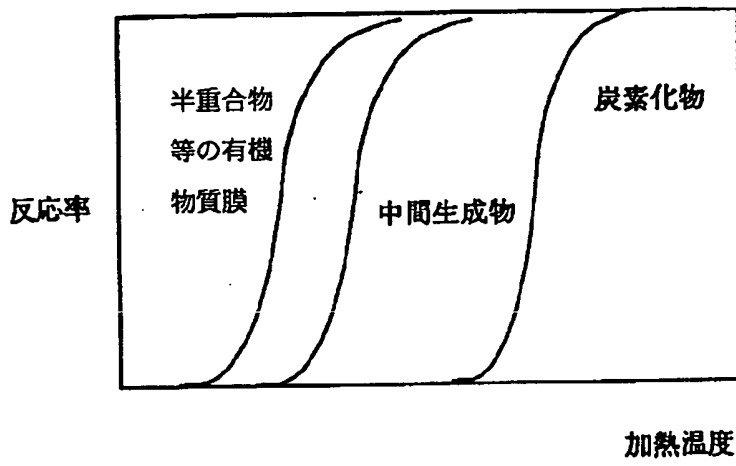
[Drawing 1]



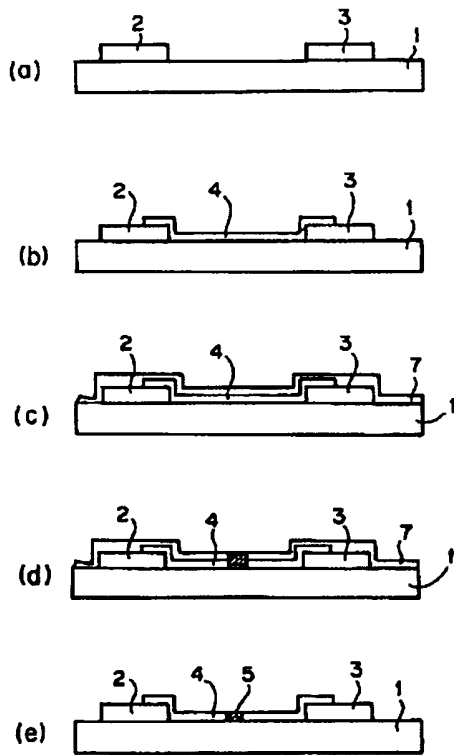
[Drawing 3]



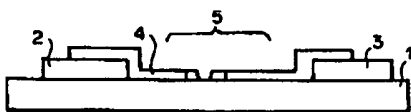
[Drawing 4]



[Drawing 6]

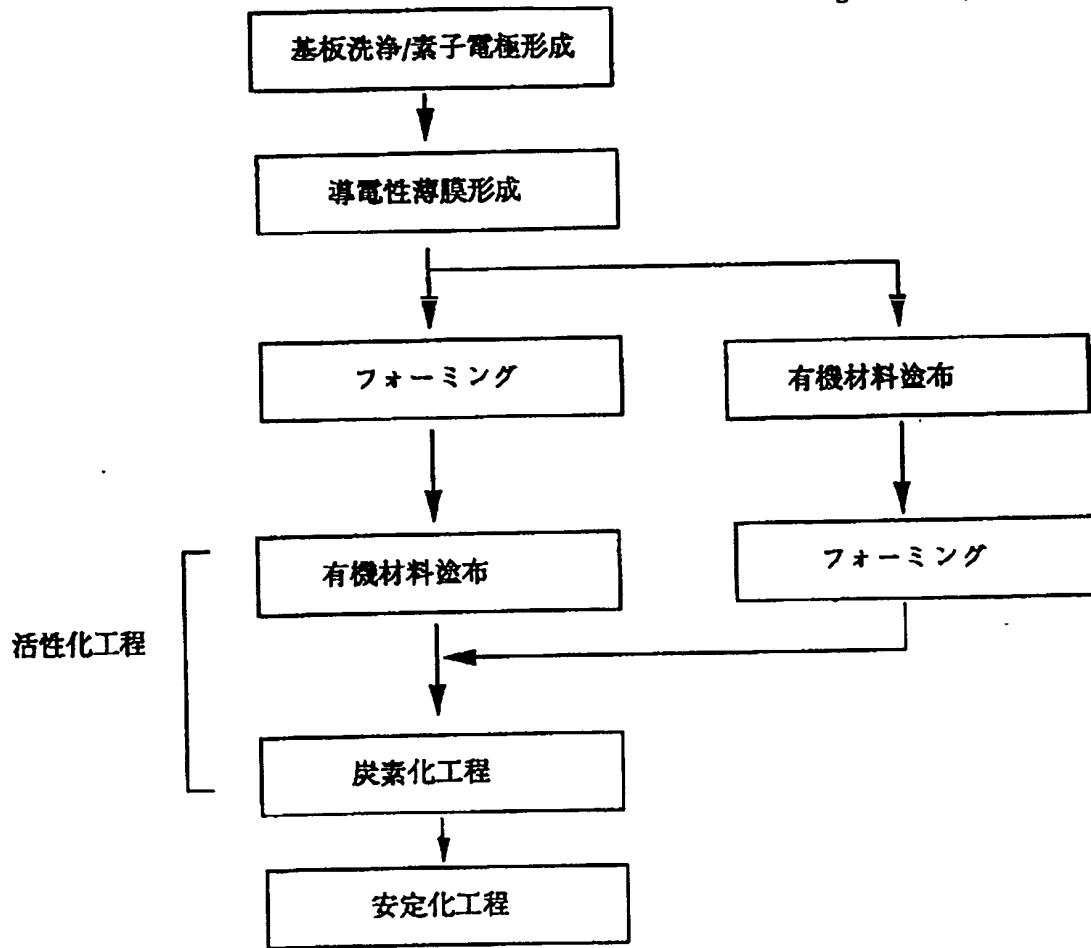


[Drawing 8]

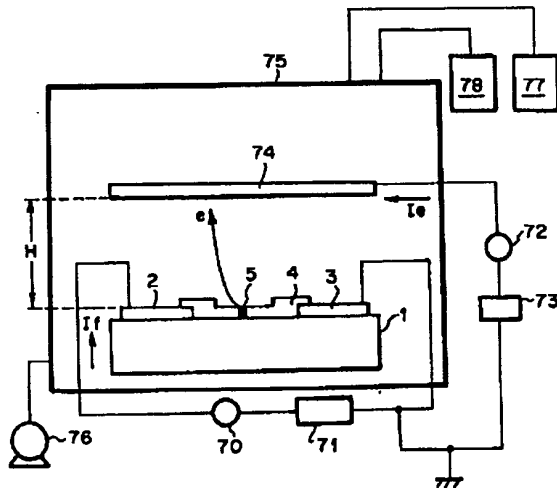


[Drawing 2]

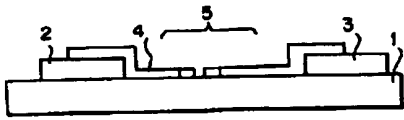




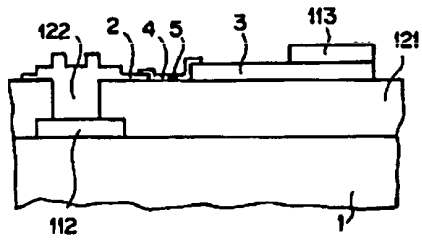
[Drawing 7]



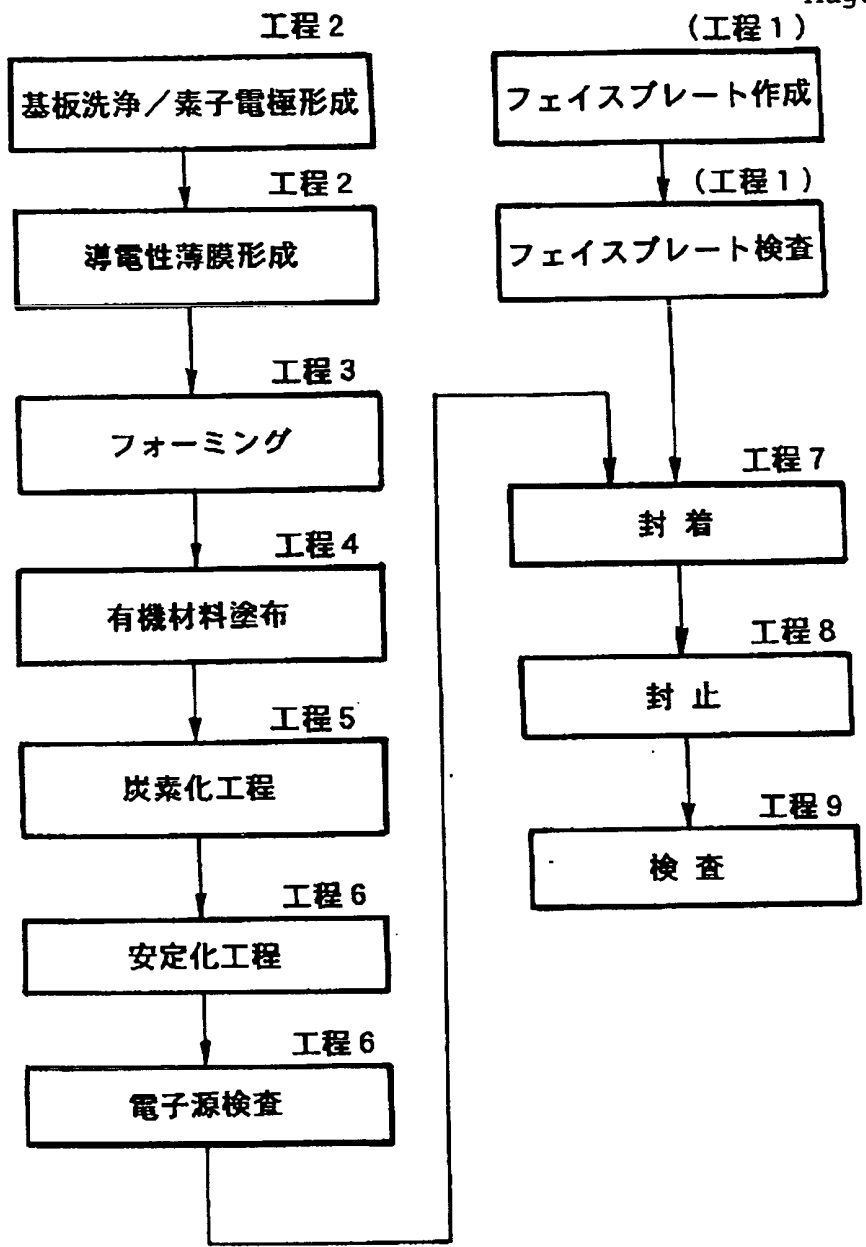
[Drawing 10]



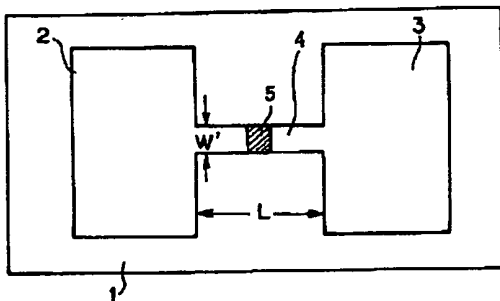
[Drawing 12]



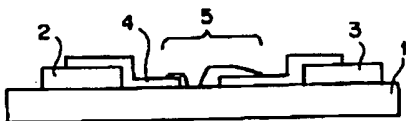
[Drawing 5]



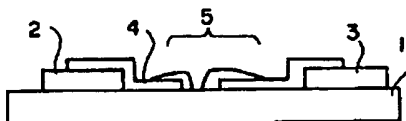
[Drawing 20]



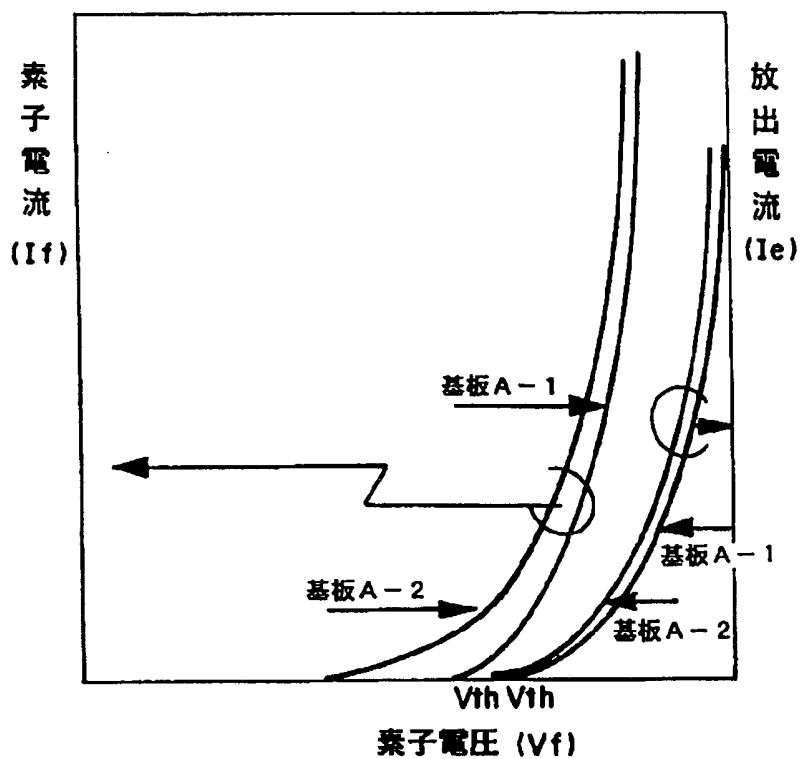
[Drawing 21]



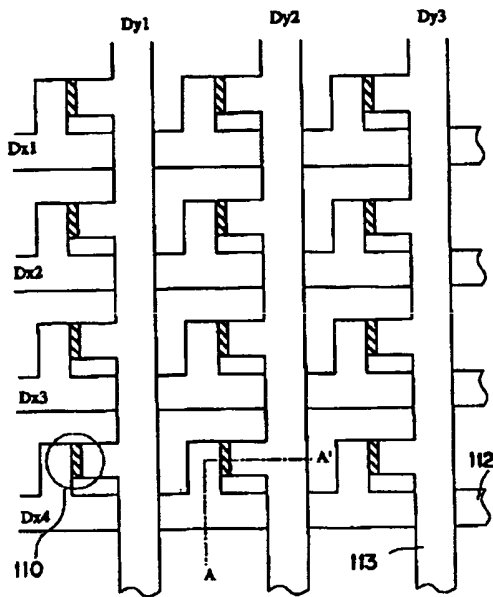
[Drawing 22]



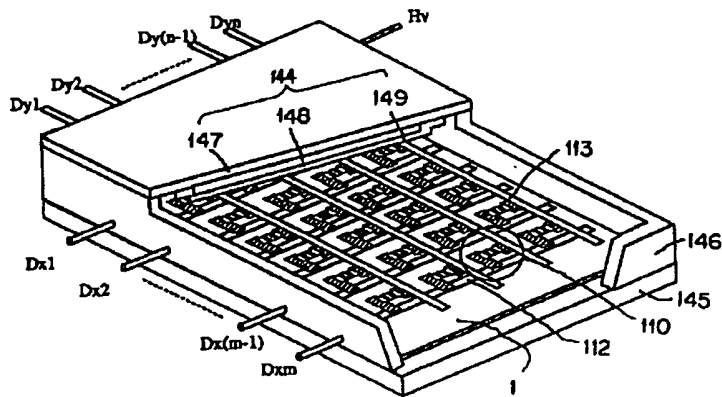
[Drawing 9]



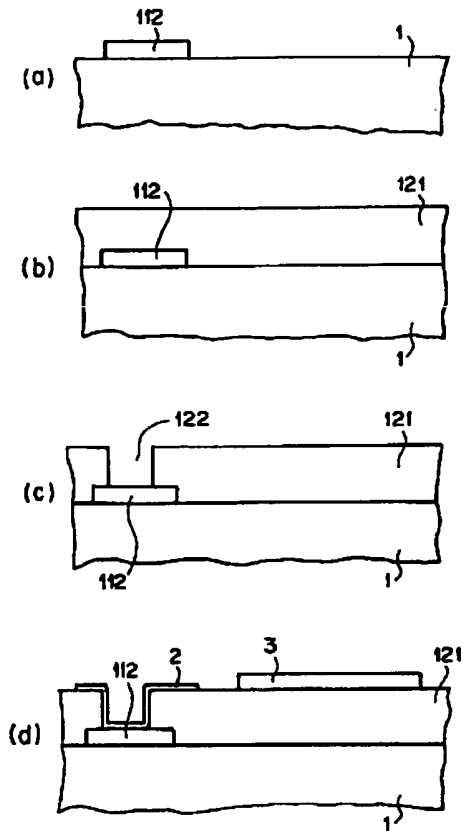
[Drawing 11]



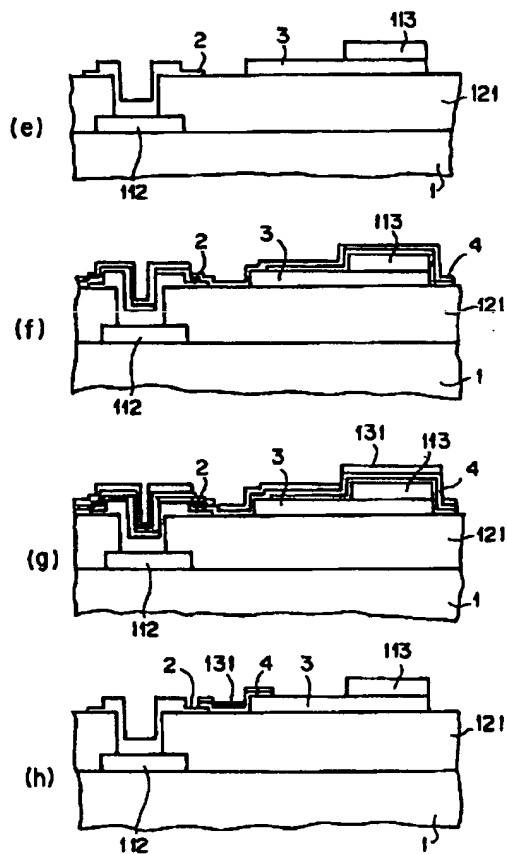
[Drawing 16]



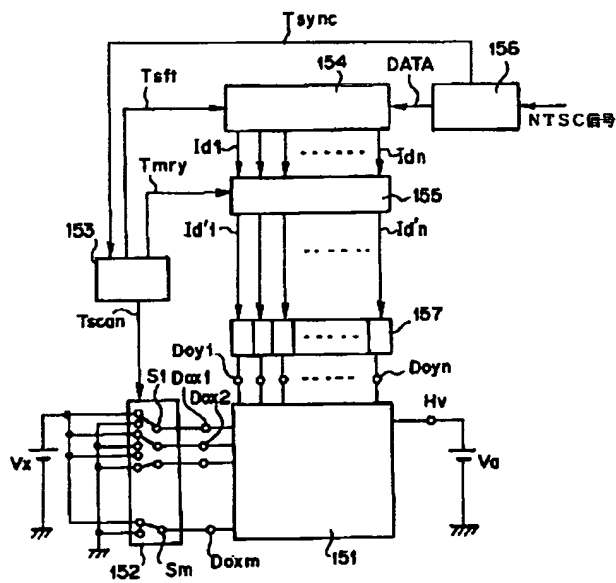
[Drawing 13]



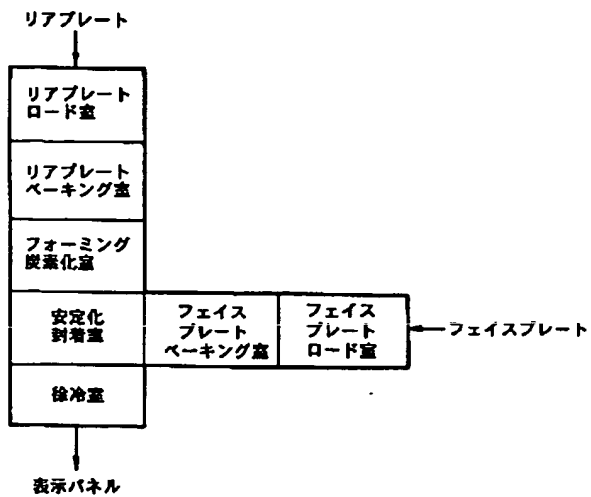
[Drawing 14]



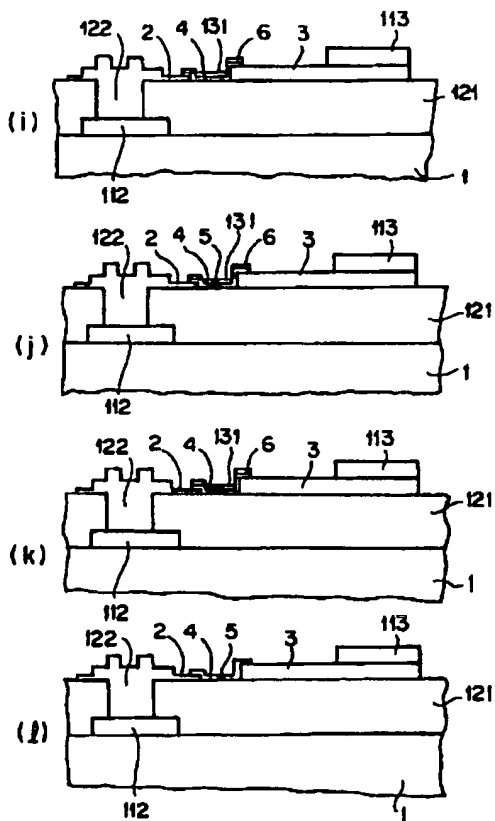
[Drawing 17]



[Drawing 19]



[Drawing 15]



[Drawing 18]



